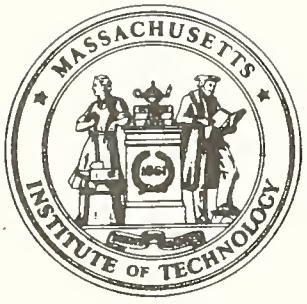

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MULTISECTOR GENERAL EQUILIBRIUM MODELS FOR EGYPT*

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Number 233 March 15, 1979

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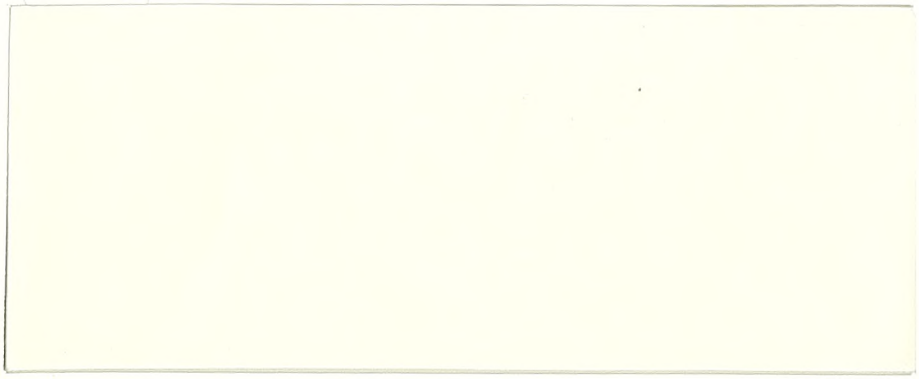

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PREFACE

The project on Improved Methods of Macroeconomic and Sectoral Planning whose progress this report describes was started in December, 1976 as part of the Cairo University/MIT Technological Planning Program. The leaders of the project are Professor Richard S. Eckaus of MIT and Professor Amr Mohie Eldin of Cairo University. They are also directly responsible for the Report which follows. Sections 1 and 2 were written by Richard Eckaus. Sections 3,4,5,6,7,8 and 9 were drafted by Amr Mohie-Eldin and edited by Eckaus who bears primary responsibility for the particular form in which this report appears.

As indicated by the list of authors and participants in the preparation of the monograph, a large number of persons have made important direct and indirect contributions which deserve identification and acknowledgement. From MIT, F. Desmond McCarthy spent a crucial two months in Cairo in early 1978. His contribution was so critical that he is listed as an author although he has no direct responsibility for the form in which the material is presented. While in Cairo, McCarthy was a member of the team there which worked especially intensively to pull together much of the data which had been in the process of estimation, to generate additional data, and to cast the model in an acceptable form and develop computer programs for the model. Professor Lance Taylor has been an invaluable advisor to the project throughout. Dr. Balbir Singh-Sihag has provided invaluable assistance at various stages as has Youssef Boutros-Ghali.

From Cairo University, Assistant Professor Goda Abdul Khalik has been a member of the project from its initiation and has made important contributions. The advice and work of Ibrahim Farag were most important at the computational stage as were the efforts of Monir Ismail and Akram Salah.

Osman Mohammed Osman also helped substantially in the more recent phases of the project in preparing the data and operating the model.

In the Ministry of Planning, Morris Abdulla and Ibrahim Salah gave invaluable assistance in the preparation of the necessary data and helped in the preparation of the chapter on the input-output table.

Dr. Amhed El Safty of Cairo University and Esam Montasser of the Ministry of Planning contributed to the Project during their association with it.

The project has, in addition, had the farsighted support of Dr. Abdul Razzak Abdul Meguid, Minister of Planning, and was started with the help of Dr. H. Mohammed Imam, the previous Minister of Planning. The encouragement of Saad Hanafi, as Deputy Minister of Planning, was essential as has been the support of Dr. Zaki Shafei, former Minister of Economy and member of the Executive Committee at Cairo University of the Cairo University/MIT Technological Planning Program.

TABLE OF CONTENTS

The Structure of the General Equilibrium Policy Models (GEMS) for Egypt[1]

[1]These models have a number of intellectual sources. The GEMS are a variation of the model developed by F. Desmond McCarthy and Lance Taylor (1978). That one is related much more distantly to the models of I. Adelman and S. Robinson (1977) and F.J. Lysey and L. Taylor (1978) and still more distantly to a number of other planning models.

1. Introduction

Any logical framework for economic policy analysis is a compromise between the ambitions of comprehensiveness and precision and the limitations of theoretical understanding, computational feasibility and data availability. The models to be presented here reflect a particular set of ambitions and a set of limitations. Both must be appreciated in order to benefit from the insights which the model makes possible and to be aware of the necessary qualifications to those insights. This presentation will, therefore, start with a critical discussion of the models, emphasizing both the capabilities and inadequacies, and will then describe the structure of the model in detail.

The model in its various versions is a simplified multisector, static, general equilibrium model (GEM) with flexible prices. In the different versions it achieves macroeconomic consistency, (GEM-1), identifies descrepancies in resource demands and availabilities as well, (GEM-2), and also adjusts resource prices and uses to resource availabilities, (GEM-3). However, as is the case with other types of policy models, it would be a mistake to judge the effectivesss of the GEMS in terms of the product of only a single solution of anyone of them. The models become powerful tools of analysis by using them to explore alternative policies which may be applied at any one time or at successive points in time.

The devising of the alternative policies to be tested and the comparison and analysis and the significance of the resulting solutions is as essential a part of the use of the models as the calculations

which are called for by the formal structure of the model and which take place in the computer. It is, in fact, useful to regard the formal structure of the model and the calculations it requires as a means of relieving the economic analyst and policy maker of the burden of a set of complex and rather tedious calculations which demonstrate the implications of a particular policy or set of policies. Yet the amelioration of that burden is itself a major achievement as it permits the examination in greater depth of many more alternatives than would otherwise be possible and frees time and attention for the exercise of economic judgment.

Since the structure of the economic models presented here is explicit, it will be seen readily that they are "unrealistic" and this is a valid criticism of the GEM models. But that, of course, is also a valid criticism of any model or theory or any other approach to understanding an economy. Theories and models in every field of science are abstractions of reality and are necessary because of the complexity of reality both in the intricacy and quantitative magnitude of the interrelations. Yet, it is a mistake to think that the "commonsense" approach of the practical man to economic issues, though it can sometimes be quite successful, avoids the simplifications which are characteristic of economic theory. Indeed, when a pragmatic and commonsense approach is successful, that stems from the ability to isolate and reduce to their most relevant essense the relationships which are the key to the circumstances. However, when this is done at the level of intuition, it is neither reproducible by others nor verifiable and acceptance of the insights

becomes a matter of faith in the individual.

Because of the complexity of economic reality, it is not possible within the structure of a single formal model to analyze all the issues and policies which are important for development. The GEM models are, therefore, intended to be the first of a set of models which will be constructed for policy analysis for the Egyptian economy. The GEM models are useful for simple macroeconomic effective demand analysis and for the study of the macroeconomic and some limited microeconomic effects of expenditure, export and import and tax and subsidy policies affecting prices and factor returns and distributional issues. The GEMS are more useful for the investigation of price and factor return issues than most other types of planning models. By comparison, they are not well suited for the exploration of the growth implications of alternative resource allocations and investment policies, for which additional models will be developed.

The decision to begin with the GEM models is partly a matter of research strategy and partly a matter of tactics. The Egyptian economy is widely regarded as characterized by a variety of goods and factor price distortions created by market imperfections and government interventions through taxes and subsidies and direct regulation. These distortions, in turn, are often thought to be major barriers to the efficient use of intermediate and final products and primary resources although, at the same time, the interventions may, to some extent, offset market distortions and help achieve distributive goals. In addition, the subsidies are widely considered a major drain on the government budget and, thus, rather directly an important source of the government deficits which are monetized and contribute to inflationary pressures. Again this may be an unwarranted attribution of

responsibility which may be more properly placed on inadequate provisions for government revenues. In any case, there is a high priority for analyses, such as the GEM models provide, which can deal with this set of issues as compared to the more conventional models framed in terms of indices or measures of amounts of "physical" goods and resources without explicit consideration of price formation influences.

There are also tactical reasons to begin with the GEM models. They are relatively easy to compute as compared to, say, dynamic simulation or programming models and much of the data necessary to implement them are more easily available.

Yet, the GEM models and, as importantly, the data which they embody, represent a major potential advance for economic policymaking for Egypt. Some of the data have never before been estimated for Egypt and all of it has never before been organized in a consistent Social Accounting Matrix. Nor has an explicit model structure of this type ever been constructed for Egypt and solutions computed. However, it is important to be modest in claims for the significance of the results though insistent on the insights obtained. To assist in this, the model will be presented in detail with each relationship being described and then the whole structure and its operation will be reviewed.

Adelman, I. and Robinson, S., Income Distribution Policies in Developing Countries: A Case Study of Korea, Stanford University Press, 1977.

Lysey, F.J. and Taylor L., "Income Distribution Simulations, 1959-1971," in L. Taylor. et al., Models of Growth and Distribution for Brazil, forthcoming, 1978.

McCarthy, F. Desmond and Taylor, L., "Macro Food Policy Planning: A General Equilibrium Model for Pakistan," forthcoming, 1977.

2. The Structure of the GEM Models[1]

A. GEM-1: The Determination of a Consistent Set of Prices, Outputs and Incomes

The GEM-1 model can, perhaps, be thought of most readily as a multi-sector macroeconomic model which determines sectoral output levels and relative output prices, value-added and factor incomes and the distribution of total income among rural and urban groups and among income class sizes within each group. In addition, consumption and imports, as well as government revenues by major type are endogenously determined. This is done with the exogenous specification of all the major components of final demand except consumption and imports and a large number of parameters as well. The latter fix the input-output ratios for intermediate uses of goods and services, the shares of labor, capital and land in value added in the various sectors as generated by a Cobb-Douglas production function and a host of marginal consumption ratios, tax-income ratios, import ratios, and so on. A glance at Tables 2 and 3, which list the endogenously determined and the exogenously specified variables and parameters, respectively, will help in an appreciation of the limits within which the formal model works. Again, however, by changing the exogenous specifications it is possible to explore a wide range of alternatives. One of the distinguishing features of the models is a relatively detailed accounting of government taxes and subsidies, tariffs and government trading activity so that the various "wedges" between production costs and prices are taken into effect.

The structure of the model is presented in Table 1. The variables are defined in Tables 2 and 3. To a considerable extent the model structure follows from the accounting presented in the Social Accounting Matrix and consists largely of the identities in that Matrix. The equations which create a descriptive theoretical model will be emphasized in the presentation.

There are 8 blocks of equations and identities in the GEM-1 model. Another block is added for GEM-2 and still another to form GEM-3. Each block will be described separately. The equations are presented in Table 1.

1. The input-output relations

These twelve production accounting relations in equations (1.1) are identities which stand at the heart of the SAM. Essentially they read across each row of the twelve productive sectors and stipulate that the sum of the various uses of domestic output of that sector must be equal to the total of domestic production of that output. The intermediate uses are $\sum_{j=1}^{12} a_{ij} X_j$, where the input-output coefficients, the a_{ij}'s, in this system are specified exogenously but can be varied parametrically to reflect technical changes. The use of output of each sector for consumption is $\sum_{k=1}^{6} QH_{ik}$, where k refers to the six personal income classes which are distinguished in the model, as noted in the SAM, Table . $QG1_i$, $QG2_i$, and $QG3_i$ are the deliveries to the three types of government sectors which are distinguished. However, since all productive public enterprises in G1 are absorbed in the producing sectors, there are no final deliveries to this sector. E_i are the exports of each sector. In some sectors all or part of the exports are traded by government which realizes a price differential PD_i on the exports. There is scope in the SAM for distinguishing deliveries of fixed investment to different

TABLE 1

EQUATIONS FOR THE EGYPTIAN GENERAL EQUILIBRIUM MODELS

1. Input-output relations

$$(1.1)\quad X_i \equiv \sum_{j=1}^{12} a_{ij}X_j + \sum_{k=1}^{6} QH_{ik} + QG1_i + QG2_i + QG3_i + PD_i + E_i + INV_i + DST_i \qquad i=1,\ldots,12$$

2. Household consumption

$$(2.1)\quad \hat{S}_k = \sum_{i=1}^{12} \Theta_{ik}B_i \qquad k=1,\ldots,6;\ i=1,\ldots,12$$

$$(2.2)\quad QH_{ik} = \Theta_{ik} + \frac{\alpha_{ik}}{B_i}[S_k - \hat{S}_k] \qquad k=1,\ldots,6;\ i=1,\ldots,12$$

3. Price determination

$$(3.1)\quad B_j = \sum_{i=1}^{12} a_{ij}B_i + HP_j + HG_j + a_{24j}B_j + a_{25j}BI_j + a_{26j}BI_j + a_{28j}BI_j + a_{29j}B_j + a_{30j}B_j + a_{32j}B_j \qquad j=1,\ldots,12$$

4. Determination of value added by sector

$$(4.1)\quad VHP_j = WAGE_j^{SPL_j}\, KAP_j^{SPK_j}\, RENT_j^{SPT_j} \qquad j=1,\ldots,12$$

$$(4.2)\quad SPL_j + SPK_j + SPT_j = 1 \qquad j=1,\ldots,12$$

$$(4.3)\quad HP_j = CH_j \cdot VHP_j \qquad j=1,\ldots,12$$

$$(4.4)\quad HM_j = HP_j \cdot X_j \qquad j=1,\ldots,12$$

(4.5) $VHG_j = WAGEG_j^{SGL_j} \; KAPG_j^{SBK_j}$ $\quad j=1,\ldots,12$

(4.6) $SGL_j + SBK_j = 1$ $\quad j=1,\ldots,12$

(4.7) $HG_j = CG_j \cdot VHG_j$ $\quad j=1,\ldots,12$

(4.8) $GM_j = HG_j \cdot X_j$ $\quad j=1,\ldots,12$

5. Income generation

(5.1) $YH_k = \sum_{j=1}^{12} HM_j \; [SPL_j \cdot SSPL_{jk} + SPK_j \cdot SSPK_{jk} + SPT_j \cdot SSPT_{jk}]$

$\sum_{j=1}^{12} GM_j \; [SGL_j \cdot SSGL_k] + RM \cdot SRM_k$ $\quad k=1,\ldots, 6$

(5.2) $YD_k = [1-a_{30,k} - a_{31,k} - a_{32,k}] \; YH_k$ $\quad k=1,\ldots, 6$

(5.3) $YET_k = [1-a_{34,k} \; YH_k/YD_k] \; YD_k$ $\quad k=1,\ldots, 6$

(5.4) $YE_k = [1-(a_{24,k}BI + a_{25,k}BI + a_{29,k}) \; YH_{k/YET_k}] \; YET_k$ $\quad k=1,\ldots, 6$

6. Government expenditure and revenue

$$(6.1)\quad G1R = \sum_{j=1}^{12} GM_j \cdot SGK_j + \sum_{k=1}^{6} a_{31,k} YH_k$$

$$(6.2)\quad G2E = \sum_{i=1}^{12} Z_{i23} B_i - 0.284 \left[\sum_{j=1}^{12} a_{30,j} B_j X_j + \sum_{k=1}^{6} a_{30k} YH_k \right]$$

$$(6.3)\quad G2R = \sum_{j=1}^{12} a_{28,j} BI_j X_j + 0.324 \sum_{k=1}^{6} QH_{26,k} BI_{26}$$

$$+ 0.2327\, Z_{26,40} BI_{26}$$

$$+ 0.957 \left[\sum_{j=1}^{12} a_{29j} B_j X_j + \sum_{k=1}^{6} a_{29,k} YH_k \right]$$

$$+ \sum_{j=1}^{12} a_{32j} B_j X_j + \sum_{k=1}^{6} a_{32k} YH_k$$

$$(6.4)\quad G3E = \sum_{i=1}^{12} Z_{i24} B_i + \sum_{j=1}^{12} a_{25j} BI_j X_j$$

$$+ \sum_{k=1}^{6} (a_{24k} + a_{25k})\, YH_k$$

$$- 0.716 \left[\sum_{j=1}^{12} a_{30j} B_j X_j + \sum_{k=1}^{6} a_{30k} YH_k \right] + \sum_{i=1}^{12} Z_{i,24'} \cdot B_i$$

$$(6.5)\quad G3R = \sum_{j=1}^{12} a_{25j} BI_j X_j + \sum_{k=1}^{6} a_{25k} YH_k + \sum_{k=1}^{6} a_{24k} YH_k$$

$$+ a_{24,5} BI_5 X_5 + \sum_{i=1}^{12} Z_{i,25} BE_i$$

$$+ 0.043 \left[\sum_{j=1}^{12} a_{29,j} B_j X_j + \sum_{k=1}^{6} a_{29k} YH_k \right] \sum_{i=1}^{12} Z_{i24'} \cdot BI$$

$$(6.6)\quad PD = - Z_{1,24'}(BE_1 - B_1) - Z_{2,24'}(BE_2 - B_2) - Z_{3,24'}(BE_3 - B_3)$$

$$- Z_{9,24'}(BE_9 - B_9)$$

7. Exports and imports

$$(7.1)\quad EXP = \sum_{i=1}^{12} Z_{i26} BE_i + RM\ BE_{21} + Z_{1,25} BE_1 + Z_{2,25}\ BE_2 + Z_{3,25}\ BE_3 + Z_{9,25}\ BE_9$$

$$(7.2)\quad IMP = \sum_{j=1}^{12} a_{25j} BI_j X_j + \sum_{k=1}^{6} a_{25k} YH_k$$

$$+ \sum_{j=1}^{12} a_{26j} BI_j X_j + 0.676 \sum_{k=1}^{6} QH_{26,k} BI_{26} + Z_{26,36} BI_{36}$$

8. Savings and investment

$$(8.1)\quad SP = \sum_{k=1}^{6} a_{34k} YH_k$$

$$(8.2)\quad SG1 \equiv G1R - G1E$$

$$(8.3)\quad SG2 \equiv G2R - G2E$$

$$(8.4)\quad SGE \equiv G3R - G3E$$

8. Savings and investment (continued)

(8.5) $SF \equiv IMP - EXP$

(8.6) $SSS \equiv SP + SG1 + SG2 + SG3 + SF$

(8.7) $INV = \sum_{i=1}^{12} INV_i B_i + Z_{26,36} BI_{36}(1.232)$

(8.8) $DST = \sum_{i=1}^{12} Z_{i,39} B_i$

(8.9) $INVT \equiv INV + DST$

(8.10) $SSS = INVT$

9. Resource demands

(9.1) $LP_i = SPL_i HM_i / WAGE_i$ $\quad i=1,\ldots,12$

(9.2) $KP_i = SPK_i HM_i / KAP_i$ $\quad i=1,\ldots,12$

(9.3) $TP_i = SPT_i HM_i / RENT_i$ $\quad i=1,\ldots,12$

(9.4) $LG_i = SGL_i GM_i / WAGEG_i$ $\quad i=1,\ldots,12$

(9.5) $KG_i = SGK_i GM_i / KAPG_i$ $\quad i=1,\ldots,12$

10. Resource constraints

(10.1) $EEL_i = LP_i - BL_i$ $\quad i=1,\ldots,12$

(10.2) $EEK_i = LK_i - BK_i$ $\quad i=1,\ldots,12$

(10.3) $EET = \sum_{i=1}^{4} LT_i - \sum_{i=1}^{4} BT_i$

TABLE 2

Endogenous Variables

B_i = price of output of i-th sector

DST - value of inventory investment

EEK_i - excess demand for capital in i-th sector

EEL_i - excess demand for labor in i-th sector

EET_i - excess demand for land

G1R - revenues of public sector enterprise and net receipts from social security system

G2E - total expenditures of conventional government sector

G2R - total revenues of conventional government sector

G3E - total expenditures of government trading sector

G3R - total revenues of government trading sector

GM_j - factor cost of government value added in sector j

HG_j - factor cost of government value added per physical unit of output of sector j

HM_j - factor cost of private household value added in sector j

HP_j - factor cost of household value added per physical unit of output of sector j

INV - value of total fixed investment

INVT - value of total investment

KG_i - government demand for capital in i-th sector

KP_i - private demand for capital in i-th sector

LG_i - government demand for labor in i-th sector

LP_i - private demand for labor in i-th sector

QH_{ik} - consumption of i-th sector output by k-th income class

TABLE 2

Endogenous Variables (continued)

S_k - total consumption expenditure by k-th income class = YE_k

$\hat{S}_k$ - value of subsistence consumption expenditure by k-th income class

SF - foreign savings

SG1 - savings of first government sector

SG2 - savings of second government sector

SG3 - savings of third government sector

SP - private savings

SSS - total savings

TP_i - private demand for land in i-th sector

VHG_j - factor cost of a unit of government value added

VHP_j - factor cost of a unit of private value added

YD_k - gross income of k-th income class adjusted for subsidies, transfers and taxes

YE_k - YET_k adjusted for purchases from government trade sector and its imports and indirect taxes

YET_k - YD_k minus private saving of k-th income class = S_k

YH_k - gross income of k-th income class

X_i - gross output of sector i

X_q - shadow prices on constraints

TABLE 3

Exogenous Variables and Parameters

a_{ij} - input-output coefficient in i-th row and j-th column

a_{mn} - all coefficients written in this form in these equations are exogenously specified ratios of the entry in n-th row and n-th column to the sum of the n-th column of the SAM matrix

α_{ik} - marginal expenditure on sector i goods by income class k

BE_i - export prices of output of i-th sector

BE_{21} - price of foreign exchange earned through remittances

BI_i - import prices of goods of type i

BK_i - supply of capital in i-th sector

BL_i - supply of labor in i-th sector

BT_i - supply of land in i-th sectors

CG_j - amount of government value added per unit of output of sector j

CH_j - amount of private value added accruing to households per unit of output of sector j

DST_i - deliveries of goods for inventory accumulation by the i-th sector

E_i - exports of the i-th sector

INV_i - deliveries of fixed investment goods by the i-th sector

$KAPG_j$ - returns to capital in government activity in sector j, exogenously specified in GEM-1 and GEM-2 and endogenous in GEM-3

KAP_j - returns to capital in private activity in sector j, exogenously specified in GEM-1 and GEM-2 and endogenous in GEM-3

PD_i - price differentials on exports imposed by the government trading sector

$QG1_i$ - exogenously specified use of i-th sector output by the first government sector which are the public enterprises

$QG2_i$ - exogenously specified use of i-th sector output by the second government sector, which is conventional government

$QG3_i$ - exogenously specified use of i-th sector output by the third government sector, which is government trading

TABLE 3

Exogenous Variables and Parameters (continued)

$RENT_j$ - returns to land in private activity in sector j, exogenously specified in GEM-1 and GEM-2 and endogenous in GEM-3

RM - remittances by migrants

Θ_{ik} - quantity of the i-th sector goods consumed by cla-s k at subsistence income, $\hat{S}_k$

SGL_j - share of labor in government value-added in j-th sector

$WAGEG_j$ - returns to labor in government activity in sector j, exogenously specified in GEM-1 and GEM-2 and endogenous in GEM-3

SBK_j - share of capital in government value-added in j-th sector

SPL_j - share of labor in private value added in j-th sector

SPK_j - share of capital in private value-added in j-th sector

SPT_j - share of land in private value-added in j-th sector

SRM_k - share of k-th income class in remittances by migrants

$SSGL_j$ - share of k-th income class in value-added by labor in j-th government sector

$SSPL_{jk}$ - share of k-th income class in private value-added by labor in j-th sector

$SSPK_{jk}$ - share of k-th income class in private value-added by capital in j-th sector

$SSPT_{jk}$ - share of k-th income class in private value-added by land in j-th sector

$WAGE_j$ - wages in private activity in sector j, exogenously specified in GEM-1 and GEM-2 and endogenous in GEM-3

Z_{i23} - expenditure by conventional government sector in outputs of various producing sectors

Z_{i24} - government trade sector purchases for domestic use

$Z_{i24'}$ - government trade sector imports

Z_{i39} - deliveries by i-th producing sector for inventory accumulation

$Z_{26,36}$ - imports of investment goods

types of purchasers, but this distinction has not yet been successfully implemented so all the investment goods delivered by each sector are aggregated into INV_i. The change in stocks contributed by each sector is similarly aggregated into DST_i. Of the uses of output of each sector only the intermediate and private consumption demands are endogenous and require explanation. All the other uses are specified exogenously.

This is a conventional specification of the uses of final demand, except that, in this accounting schema, all imports are treated as if they were non-competitive imports. Thus, the intermediate flows in the input-output table do not include the allocation of imports defined by sector to each using sector. As a result, it is not necessary to subtract imports from final demands in order to obtain only the gross domestic production of each sector.

2. Private consumption

The determination of private consumption is endogenous to the model and follows the linear expenditure system suggested by R. Stone (1954). For each income class, k, a base level of total consumption expenditure, $\hat{S}_k$, is estimated in (2.1) which can be interpreted as a subsistence level which is independent of both price and income effects. The $\hat{S}_k$, in turn, is a price weighted sum of amounts of commodities Θ_{ik} consumed independently of price and income effects. Then the actual expenditure on consumption of the output of each sector by each income class is computed in equation (2.2) as the sum of the Θ_{ik} and the product of a marginal expenditure share, normalized by price, α_{ik}/B_i, times the difference between total expenditure $S_k (=YET_k)$ by class k and $\hat{S}_k$.

3. Price determination

Output prices are determined in this model essentially on a mark-up basis on value added in each sector in equations (3.1). For each sector, j, all the costs of intermediate inputs are first added up. These are $\sum_{i=1}^{12} a_{ij}B_i$, where B_i, again, are sectoral prices. These costs are added to private value added per unit of output, HP_i, and government value added per unit of output, HG_i. Then each of the contributions to unit costs deriving from domestic government trade $a_{24j}B_j$, government trade imports, $a_{25j}BI_j$, where BI_j are exogenously specified import prices, other imports, $a_{26j}BI_j$ and import tariffs, $a_{28j}BI_j$ are added. The costs of indirect taxes, $a_{29j}B_j$, are also added and government subsidies per unit, $a_{30j}B_j$, are subtracted. Any direct taxes on sectoral output, $a_{32j}B_j$, are included. The a_{mj}'s are parameters specified as ratios of the values of the various concepts in the mj box in the SAM matrix to total output of the j-th sector, but can be changed exogenously.

4. The determination of value added by sector

The cost of a unit of value-added in each producing sector is computed separately for the private and government sectors. The computation is based on the assumption of the use of primary factors in a Cobb-Buglas production functions so that costs can be computed from the corresponding cost functions (4.1) and (4.4). The shares of households in value added in private and government production, CH_j and CG_j, in each sector are used in (4.2) and (4.5) to determine the household value added per unit of output in each sector. This in turn is multiplied by total output in each sector, X_j, to obtained total household value added in private production and government activity in each sector j.

The use of the Cobb-Douglas production function with its accompanying assumption of constant returns to scale and constant factor shares is, of course, open to skeptical questioning as a general procedure for developing or even advanced countries. Moreover, the use of that production function to derive a cost function as shown assumes competitive markets for primary resources. This is also clearly an assumption which is not generally warranted, and especially not in developing countries. However, in a static model intended only to investigate the significance of alternative policies within a limited range of alternatives, the Cobb-Douglas production function device is not only plausible but realistic. The assumption of competitive resource markets is also not particularly critical for small policy changes as the initial distributions of value added among resources can be specified exogenously.

5. Income generation and definition

The gross income earned by income each class, YH_k, is computed in (5.1) by calculating the shares of each income class in value added in each sector. Private value added in each sector, HM_j, is decomposed into returns to labor, capital, and land, using the share ratios for each sector SPL_j, SPK_j, and SRT_j. The shares of each income class in those returns are calculated using the income class share ratios $SSPL_k$, $SSPK_k$, $SSPT_k$. Only the labor share in government value added in each sector, GM_j, is calculated as part of household income using the labor share ratio SGL_i. Then that labor share is distributed among income classes using the share of each class in government labor income, $SSGL_k$. In addition, total remittances RM are distributed among income classes using a class share ratio SRM_k.

A gross disposable income concept for each income class is calculated in (5.2) by using ratios which add subsidies, $a_{30,21}$, subtract transfers, $a_{31,21}$, which are net payments to the social security system, and subtract direct taxes, $a_{32,21}$.

In equation (5.3) the amount left for expenditure after deduction of savings, determined by the ratio $a_{34,21}$, is calculated. And finally in (5.4), the net total private expenditure by each income class is calculated after subtracting the expenditure on government traded goods, the value of expenditure on government traded imports, and the indirect taxes paid by each class as determined by the appropriate ratios.

6. Government expenditures and revenues

The government sector as reported in the SAM is divided into three categories: G-1, mainly publicly owned productive enterprise, G-2, the conventional government sector, and G-3, the government trading or supply sector involving purchase and sale of commodities.

G-1, the public enterprise sector has no expenditures as these are all captured in the sector in which the enterprises are located. The revenues of the public enterprise sector G1R, calculated in (6.1), are, first of all, the earned surpluses which are computed by multiplying the value added in that sector GM_j by the share retained by the enterprise, SBK_j and summing over all productive sectors. For convenience, the net payments to the social security system are also included in the revenues of this sector. These payments are the product of the payments per unit of gross income by each income class, $a_{31,k}$, times the gross income of each income class YH_k summed over all income class.

G2E, the expenditures by the conventional government sector, in (6.2), include the value of the expenditures on the output of the various producing sectors $\sum_{i=1}^{12} Z_{i23}B_i$ plus that part of the net subsidies paid by this conventional government sector. These subsidies are listed as negative items in the SAM so are preceded by a minus sign to convert them into positive expenditures. The total subsidies paid are the sum of the subsidies paid to each producing sector $\sum_{j=1}^{12} a_{30j}B_jX_j$, where the a_{30j} are the subsidy rates, plus the subsidies paid to the household sector $\sum_{K=1}^{6} a_{30,k}YH_k$, where the coefficients $a_{30,k}$ are the subsidy rates. Of this total, 28.4 per cent is paid by the conventional government sector and included in its expenditures.

The revenues of the conventional government sector in equation (6.3) are the returns from the various taxes. The first are the tariffs on imports of intermediate goods by the various producing sectors $\sum_{j=1}^{12} a_{29j} BI_j X_j$, where the a_{28j} coefficients are the tariff rates and the BI_j are the import prices. To this are added tariffs paid on imports by the household sector which are $\sum_{k=1}^{6} QH_{26k} BI_{26}$ for which the average tariff rate is 0.324. Then the tariffs revenue on imports of investment goods, $A_{26,40}$, is added at the average rate of 0.2327.

The second type of revenue source is indirect taxes. The indirect tax rates, $a_{29,j}$, in each sector are multiplied by the value of each sector's output and summed for all sectors. Similarly the average indirect tax rates applied on consumer's expenditure of each income class, $a_{29,k}$, are applied to the gross income of that class. However, only 95.7 per cent of these are received by this sector; the remainder, as will be seen, are recorded as revenue to the government trade sector.

Finally, direct taxes are paid by the producing sectors at the rates a_{32j} and by the various income classes at the rates a_{32k}. So these rates are applied to the corresponding output or income concepts.

The expenditures of the government trading sector G^3E in (6.4) again have a number of components. The first is the sum of purchases by this component of government of the output of the various producing sectors $\left\{\sum_{i=1}^{12} 2_{i24} B_i \cdot\right\}$ The next component is the sum of imports by this sector, $\left\{\sum_{j=1}^{12} a_{25j} BI_j X_j,\right\}$ where these are valued at import prices, BI_j. As will be seen, this is offset by a corresponding revenue to the sector reflecting sales to the private sectors. Next must be added the sum of imports by this sector on behalf of

consumers $\sum_{K=1}^{6} a_{25k} YET_k$ which will again be recorded as revenues when sold to consumers. The total subisdies are computed again, as for the conventional government sector, and 76.1 per cent of these are paid by this government trading sector. Finally, expenditures on domestic goods supplied to consumers are $\sum_{K=1}^{6} a_{24k} YET_k$.

The revenues of the government trading sector are first of all the imports by this sector sold to the producing sectors and consumers $\sum_{j=1}^{12} a_{25j} BI_j X_j + \sum_{K=1}^{6} a_{25k} YH_k + \sum_{K=1}^{6} a_{24k} YH_k$. There is also a revenue from direct sales to the food processing sector $a_{24,5} BI_5 X_5$. The revenue from direct exports by government are the sum of the exports of the first, second and third sectors, 17,2 and 100, respectively valued at their domestic prices. With the latter initialized at unity, the total is 119, as in the SAM row 24 column 26. The 4.3 percent of indirect taxes collected by this sector are entered next.

Finally, the price differentials collected by this government sector on certain exports are added; as these are calculated as negative numbers, they are preceded by a minus sign.

These price differentials as calculated in (6.6) arise because of the difference between the domestic price B_j, at which the government trading sector buys some part of the output of sectors 1, 2, 3, and 9 and the export price, BE_j, at which it sells. The particular items are respectively, by sector, rice, onions, cotton and oil products. The particular quantities of each export are multiplied by the price differential. The export prices of the items in the various sectors are set at 2, 3, 1.55 and 3.041 times the initialized price of unity in the respective domestic sectors.

7. Exports and imports

The first term in the export equation (7.1) is the sum of the exports of the various producing sectors valued at their export prices, $\sum_{j=1}^{12} A_{i26}BE_i$. The remittances of Egyptian workers abroad is entered here, RM BE_{21}, as a foreign exchange earning by a domestic factor. And, finally, the exports by the government trading sector which entered as revenues in that sector must also be recorded here.

It may be noted again that all imports are treated as if they were non-competitive. The first term in the import equation is $\sum_{j=1}^{12} a_{25j}BI_jX_j$, the sum of the imports of each sectoral type by the government trading sector and which entered as an expenditure by that sector. The second term is the sum of consumption goods imports by the government trading sector for the various income classes $\sum_{k=1}^{6} a_{25k}YH_k$, which was also an expenditure by that sector. The direct imports for the various producing sectors is the sum $\sum_{j=1}^{12} a_{26j}BI_jX_j$. The imports by the household sectors itself are $\sum_{k=1}^{6} QH_{26,k}Bi_{26}$. But only (125/185) of that is the c.i.f. value of the imports, the remainder, (60/185) being tariff duties. The final term, $Z_{26,36}BI_{36}$, is the value of imports of investment goods.

8. Savings and investment relations

Total saving SSS (in 8.6) is the sum of savings by households, SP, saving by the various government sectors, SG1, SG2 and SG3 and foreign saving, SF. Household saving (8.1) is computed by applying savings coefficients to gross household income, $\sum_{k=1}^{6} a_{34k}YH_k$. Saving by each type of government is defined in equations (8.2), (8.3), and (8.4) as the difference between its revenues and expenditures. Foreign saving in equation (8.5) is the difference between imports and exports.

Total fixed investment in equation (8.7) is the sum of the deliveries of investment by the various sectors $\sum_{i=1}^{12} Z_{i36}B_i$ plus the imported investment good valued at import prices with the latter being "inflated" by proportion of import tariffs in the total value of imported investment goods, $Z_{26,36}BI_{36}$ (1.232). All of the physical values are specified exogenously.

The change in inventories in each sector is also specified exogenously as $Z_{i,39}$ but the value is computed by multiplying by the price in (8.8).

Total investment, INVT is the sum in (8.9) of fixed investment and inventory investment.

Finally, the equilibrium and balance condition for the GEM-1 model is that total saving must be equal to total investment as (8.10).

9. Overview of the GEM-1 model

As is more apparent from a review of the identities and equations which make up the structure of the GEM-1 model, it is a static consistency model. It contains exogenous demand and factor share specifications, the assumption of Cobb-Douglas production and cost functions, price mark-up assumptions and assumes constancy in a number of input-output, consumption, tax, import and other ratios. If there were only two goods and one class of income recipients, GEM-1 would appear to be a rather simple model of consistent price and output determination with a detailed accounting of government sector activities. With a number of sectors and a number of classes of income recipients, the model gains considerably in richness as the assumptions implicit in more aggregated models, of constancy in the relative proportions of the outputs of the sectors and of income distribution and consumptions proportions, can be dropped. Nonetheless, GEM-1 remains solely a model of consistent price and

output determination.

It may be useful to note the differences between the conventional input-output models and the GEM-1 model. The GEM-1 model is closed on the output side by the endogenous determination of consumption and import requirements, instead of these being exogenously specified. Secondly, the assumption of Cobb-Douglas production functions for the use of primary resources, with the additional assumption of competition in the factor markets, makes it possible to determine the cost of value-added per unit of output in the various sectors. Then, with factor shares and income class shares in value added assumed to be constant, this in turn not only permits the determination of prices, assuming that they are equal to costs of intermediate inputs and value added, but also the distribution of incomes. The detailed accounting of government taxes and expenditures is extended by the assumption of constancy of tax/income or tax/output ratios to permit the calculation of the effects of various policies on government revenues or the calculation of the effects of changes in government tax and expenditure policies, as embodied in tax ratios and sectoral expenditure levels. Import and export and sectoral investment policies can be analyzed similarly for their effects on output levels, consumption and import levels and prices and other endogenous variables.

B. The GEM-2 Model

This model, as indicated previously, is a small extension of GEM-1 in that the demands for the various resources are calculated from the solutions of GEM-1. The results of this calculation can then be compared with the available resources as a basis for judgement as to the feasibility of a solution. It should be emphasized that the model itself does not force

a feasible solution but remains only a consistency model. However, it does provide additional information with which to judge feasibility.

The demands for the various resources in the various producing sectors are calculated by dividing the total returns of each resource by their rate of return. This is done by specifying parametrically the shares in value added of each type of factor, labor, capital and land, in each of the private sectors and the public sector, separately. These parameters are SPL_i, SPK_i and SPT_i for the private sector and SGL_i and SGK_i for the public sector. Multiplying these parameters by total value added in each sector HM_i and GM_i and dividing by the nominal wage rate, capital services return and land rental, $WAGE_i$, KAP_i, $RENT_i$ for the private sector and the corresponding rates for the public sector, $WAGEG_i$ and $KAPG_i$, provides the estimates of resource demands. These calculations are done in equations (9.1)-(.6).

C. The GEM-3 Model

In the GEM-3 version of the model, resource constraints are applied and must be satisfied by the solution. The constraints are written separately for labor, capital and land and there is actually considerable flexibility in the manner of their specification. The equations in (10) represent only one possible set.

Equation (10.1) says the excess demand for labor in each sector is equal to the actual demand, LP_i, minus the exogenously specified sectoral supply. Alternatively this could be written in terms of demands and supplies of private and government demands and supplies in total or by sectors, implying some lack of substitutability, or even in terms of particular types of labor in one or more of the sectors.

Equation (10.2) is an analogous constraint on capital. It would be possible to respecify this in order to account for excess capacity in the various sectors. Again, private and government demands and supplies of capital could be distinguished in the various sectors and it would be possible to add demands and supplies of capital in sectors, perhaps those in agriculture, where there is substitutability.

Equations (10.3) and (10.4) specify alternative versions of the land constraint. In (10.3) the demands and supplies for land in n sectors are added, implying substitutability. In equation (10.4) the demands and supplies of each sector are treated separately. It should be noted that in calculating land demands and supplies account must be taken of the potentials for multiple-cropping but also the constraints of crop rotation.

In order to adjust to the resource constraints, the GEM-3 model will change the proportions in which primary factors are used in the various types of production. That is, the specification of the Cobb-Douglas production function makes it possible for substitution to occur among labor, capital, and land, with corresponding changes in wages, the rate of return to capital, and rents. In turn, that will change the proportions of value added in the various sectors, the income generated and the distribution of income. Similarly, prices of the outputs of the various sectors will change and the effects will run through the entire system. Thus the solution to the model in all of its aspects will adjust to the relative availabilities for the various primary resources.

It should be noted that, while relative factor prices respond to relative factor availabilities, the absolute levels of prices and incomes are set by the macroeconomic condition that savings equal investment. It is tempting but inaccurate to fall into the habit of thinking of product and factor prices and incomes as being set by market forces of supply and demand, when it is the overall equality of savings and investment which moves the system into a consistent equilibrium.

It should be emphasized that the GEM-3 model is still a static one, so that different solutions represent alternatives, rather than temporal changes. However, if the exogenously specified resource supply constraints and other conditions are given a temporal interpretation, then the alternative solutions generated can also be given such an interpretation. However, the GEM-3 model will still only indicate the characteristics of the feasibility conditions of the constraints imposed, and not whether the constraints themselves, for example the supply constraints on labor or capital, are plausible.

Nonetheless, the GEM-3 model is one with considerable richness in the range of issues which it permits to be analyzed and should make a substantial contribution to policymaking in Egypt.

3. The Social Accounting Matrix (SAM)

The Social Accounting Matrix (SAM) provides a useful vehicle for organizing the data. It is of particular significance for the equilibrium model which is used here to test different types of economic policies. The structure of the matrix that we used is set out schematically at the end of this note in Table 4. It is composed of 40 rows and 40 columns. In the north western block of the matrix (Block No. I) is the interindustry matrix, composed of twelve sectors which represent an aggregation of the original 27 x 27 input-output table. These twelve sectors are:[1]

1 - Staple food

2 - Non-staple food

3 - Cotton

4 - Other agriculture

5 - Food processing industries

6 - Textile industries

7 - Other industries

8 - Construction

9 - Crude oil & products

10 - Transport & communication

11 - Housing services

12 - Other services

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[1]The details of this disaggregation and aggregation are presented in the note on the I/O Table.

SOCIAL ACCOUNTING MATRIX
for
EGYPT 1976

M.E.E.

Receiving / Sectors	1. Staple Food	2. Non-staple Food	3. Cotton	4. Other Agriculture	5. Food Processing Industry	6. Textile Industry	7. Other Industries	8. Construction	9. Crude oil & Products	10. Transport & Communication	11. Housing	12. Other Services	13. Total Intermediate (Σ1–12)	14. Total Final Demand
1. Staple Food	46.6727	—	—	—	179.6235	—	—	—	—	1.3611	—	10.18230	238	217
2. Non staple Food	16.7613	372.5629	8.47093	5.91269	350.7244	8.05422	0.38911	—	—	10.11618	—	17.46674	416	252
3. Cotton	—	—	0.40303	—	153.937	73.09589	2.20419	—	—	—	—	—	75	160
4. Other Agriculture	54.5784	282.05030	9.92237	2.13755	5.95715	34.46790	1.76421	—	—	0.61798	—	0.27145	392	72
5. Food Processing Ind	—	39.92213	—	—	144.30160	3.77228	1.61896	—	—	2.17375	0.00846	93.21645	290	1232
6. Textile Industry	1.13642	0.05167	3.29103	0.02107	1.41447	310.59292	1.30919	1.11537	0.22304	0.26195	0.02569	53.05059	373	512
7. Other Industries	1.35769	0.16335	2.91491	0.21115	1.54634	13.57468	44.0495	112.8930	9.00784	1.51700	0.16177	70.11044	292	1100
8. Construction	—	1.17015	0.13579	—	0.57014	1.77530	0.9910	0.5240	2.41416	3.24410	5.66571	14.45182	77	599
9. Crude oil & Products	12.77104	30.59458	3.91501	2.00618	3.41795	12.06515	11.05758	306.6350	132.4516	35.36494	—	80.81435	355	254
10. Transport & Comm	0.20951	0.40548	0.21384	0.02907	0.54435	2.08550	0.61201	2.16594	0.21176	2.10167	0.00697	313.9710	40	537
11. Housing	0.03304	0.01099	0.01148	0.00192	1.00936	0.65231	0.40390	0.13597	0.41706	0.35143	—	6.31525	10	152
12. Other Services	2.90146	16.47459	7.71460	0.53209	31.94586	93.16751	41.5930	335.3951	12.35750	26.31286	2.15139	47.5134	968	2150
13. Total Inputs Σ1–12	130	408	29	11	719	487	201	382	157	87	8	867	3486	7817
14. Value Added	317	806	202	638	166	330	509	256	324	456	136	2049	6061	
15. Urb Lower	0.0	0.0	0.0	0.0	90.566	91.963	66.735	36.260	0.923	52.356	34.076	631.421		
16. Urb Middle	0.0	0.0	0.0	0.0	45.177	87.570	67.166	35.473	23.425	61.363	70.122	646.941		
17. Urb Top	0.0	0.0	0.0	0.0	64.255	72.629	79.166	75.217	45.618	79.351	50.501	[illegible]		
18. Rur Lower	135.140	[illegible]	90.312	60.271	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
19. Rur Middle	37.207	246.066	58.507	120.271	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
20. Rur Top	71.551	245.544	53.177	127.915	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
21. Households Value Added	302	755	202	438	150	277	276	170	75	193	125	1962	4923	
22. Gov & Pub Value Added	15	51	-	-	16	53	295	86	249	261	9	97	1118	
23. Gov Conventional														
24. Gov Trade					25								25	
25. Gov Trade Imports	12	37	10	8	391							96	552	
26. Other Imports	7	22	4	15	9	67	435		66	51			656	
27. Total Imports	19	59	16	23	425	67	435		66	51		96	1208	
28. Imp Tariffs	1	5			166	12	100		42				326	
29. Ind Taxes					205	65	35		15			20	340	
30. Subsidies (-)	-12	-10	-10	-8	-182	-86	-3		-8	-15		-12	-346	
31. Gov Transfers														
32. Dir Taxes					25	30	55		13			100	223	
33. Σ28–30														
34. Priv Savings														
35. Gov & Pub Savings														
36. Gov Conv Deficit														
37. Gov Trade Deficit														
38. Foreign Finance														
39. Change in Stocks														
40. Total Savings														
41. Gross Prod	655	1268	235	666	1522	885	1392	636	609	577	162	3118	11303	
Population (m l)														
Income Shares														
Population Shares														
Per Capita Income														
Income ...														

Receiving / Sectors	15. Urb Lower	16. Urb Middle	17. Urb Top	18. Rur Lower	19. Rur Middle	20. Rur Top	21. Total Households	22. Gov & Pub Sector (G_1)	23. Gov Conventional (G_2)	24. Gov Trade (G_3)	25. Price Diff.	26. Exports	27. Total Exports
1. Staple Food	22.0	13.5	5.3	22.6	7.1	4.5	75		14	95	17		17
2. Non staple Food	17.6	156.6	110.7	114.0	65.8	53.3	710		60	28	4	49	53
3. Cotton	1.6	0.3	0.4	1.6	0.6	0.5	5			100	55		55
4. Other Agriculture	14.3	16.4	11.8	7.2	4.3	2.0	56					16	16
5. Food Processing Ind	321.5	295.1	140.4	233.6	100.6	70.8	1146		50			26	26
6. Textile Industry	79.9	97.2	55.1	38.2	30.9	25.7	327		27			109	109
7. Other Industries	95.6	99.1	60.3	45.1	23.3	19.6	343		268			89	89
8. Construction	—	—	—	—	—	—							
9. Crude oil & Products	21.9	18.4	9.4	11.8	4.7	2.5	69		35		100	49	149
10. Transport & Comm	30.0	45.4	170.5	7.8	6.3	4.7	265		100			172	172
11. Housing	16.7	37.4	55.3	4.4	3.9	6.3	128		4				
12. Other Services	205.3	223.2	152.7	78.1	63.4	76.3	802		1013	42		171	171
13. Total Inputs Σ1–12	991.4	1014.6	772.2	565.4	311.9	245.5	5926		1571	265	176	681	857
14. Value Added													310
15. Urb Lower												65.1	
16. Urb Middle												81.9	
17. Urb Top												93.0	
18. Rur Lower												25.42	
19. Rur Middle												20.46	
20. Rur Top												16.12	
21. Households Value Added												310	310
22. Gov & Pub Value Added													
23. Gov Conventional													
24. Gov Trade	20.2	15.2	7.6	19.9	11.4	4.7	79			768		119	119
25. Gov Trade Imports	50.7	45.2	31.9	44.1	29.4	14.7	216						
26. Other Imports	15.5	30.4	67.3	11.6	19.5	13.7	125						
27. Total Imports							741						
28. Imp Tariffs							60						
29. Ind Taxes	37.9	37.2	31.1	19.3	15.0	7.5	150						
30. Subsidies (-)	-63.8	-48.4	-23.6	-12.9	-9.8	-7.5	-168		146	368			
31. Gov Transfers	78.7	94.3	123.0	-	-	-	296						
32. Dir Taxes	6.2	33.7	70.7	3.7	15.1	25.6	155						
33. Σ28–30													
34. Priv Savings	-96.8	-98.2	202.9	69.9	173.5	172.8	594						
35. Gov & Pub Savings								1414					
36. Gov Conv Deficit									-393				
37. Gov Trade Deficit										-389			
38. Foreign Finance													654
39. Change in Stocks													
40. Total Savings							394	1414	-393	-389			659
41. Gross Prod	1043	1126	1305	721	535	503	5233	1414	1324	1012	176	1110	1940
Population (m l)	12.713	6.399	2.133	10.137	5.069	1.690							
Income Shares	0.3302	0.3241	0.3757	0.4077	0.3042	0.2359							
Population Shares													
Per Capita Income	81.417	175.965	611.814	71.112	105.514	297.653							
Income ...	260.79	543.10	1957.80	227.56	337.74	952.43							

Receiving / Sectors	28. Import Tariffs	29. Ind. Taxes	30. Subsidies	31. Gov. Transfers	32. Dir Taxes	33. Σ	34. Priv Invs.	35. Gov & Pub Invs.	36. Gov. Conv. Invs	37. Gov. Trade Invs	38. Foreign Invs	39. ΔS	40. Total Invs.	41. ΣΣ Gross Production	
1. Staple Food												16	16	655	1
2. Non staple Food													1	1268	2
3. Cotton														235	3
4. Other Agriculture														666	4
5. Food Processing Ind												10	10	1522	5
6. Textile Industry									3			46	49	885	6
7. Other Industries									360			40	400	1392	7
8. Construction									599				599	636	8
9. Crude oil & Products												1	1	609	9
10. Transport & Comm														577	10
11. Housing														162	11
12. Other Services									122				122	3118	12
13. Total Inputs Σ1–12									1685			113	1198	11303	13
14. Value Added				296										6647	14
15. Urb Lower														1043	15
16. Urb Middle														1126	16
17. Urb Top														1305	17
18. Rur Lower														721	18
19. Rur Middle														535	19
20. Rur Top														503	20
21. Households Value Added														5233	21
22. Gov & Pub Value Added				296										1414	22
23. Gov Conventional	477	469			379									1324	23
24. Gov Trade		21												1012	24
25. Gov Trade Imports														768	25
26. Other Imports									391				391	1172	26
27. Total Imports													391	1940	27
28. Imp Tariffs									91				91	477	28
29. Ind Taxes														490	29
30. Subsidies (-)														—	30
31. Gov Transfers														296	31
32. Dir Taxes														578	32
33. Σ28–30														—	33
34. Priv Savings														594	34
35. Gov & Pub Savings														1414	35
36. Gov Conv Deficit														-398	36
37. Gov Trade Deficit														-389	37
38. Foreign Finance														654	38
39. Change in Stocks														—	39
40. Total Savings														1680	40
41. Gross Prod	477	490	—	296	378				1567			113	1680		

The final private consumption demands in block two (columns 15-20 and 21) are assumed to come from six socioeconomic classes. There are three income classes distinguished for urban and rural consumers separately with income recipients divided among the lowest 60%, the middle 30%, and the top 10% of the household distribution in each case. However it should be noted that "rural" in this distinction of income classes means just the agricultural population and agricultural incomes[2]. The final demands of the government sector were subdivided into three categories (columns 22 to 24): the public sector, conventional government, and the government trading sector. These categories made it possible to distinguish quite different types of activities. The special emphasis on government trading sector is justified because through that sector the activities of the General Supply authority are carried out by means of which basic consumer necessities are provided to the household sector in the ration shops (consumer cooperative) and where subsidies are incurred.

The final demands also include exports (columns 25,26 and 27),which cover the government trade exports, a price differential realized on government trade exports and other exports. Although the treatment of exports and other expenditures in the matrix provides consistent totals, it is useful to understand the detail behind this treatment and that another accounting of the detail is more enlightening with respect to exports. Such an alternative is presented in Table 5 which disaggregates columns (24) and (26) and generates a new column (27).

In the original SAM, column (24) includes purchases by the government

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[2]For the reasoning behind this procedure see the discussion on distribution.

trading sector both for domestic use and for exports. It should be noted that the exports by the government trading sector in column (24') are valued at domestic prices. Separating these purchases for domestic use and export permits clearer identification of all those goods which are exported. This separation is done in Table 5 by presenting two columns (24) and (24'). The only somewhat inconsistent convention in this column is that the LE49 million of oil exports are considered as if carried out by the government trading sector rather than by the oil enterprises. These are, of course, public but all such public enterprises are included with private sector enterprise in the classification scheme.

Column (25) lists the "price differences" in each sector which are created when the government buys at a lower price domestically than the price at which it sells the goods in foreign markets. The price differences in this convention carry negative signs. Column (26) lists the exports by the private sector. This includes exports by public enterprises except for crude oil and products.

Total exports at domestic prices in column (26') are the sums in each row of government exports at domestic prices in column (24') and private exports in column (26). The entries in this column are, therefore, valued at the same prices as the other entries in SAM. Finally, column (27) presents exports in each sector valued at foreign prices which are obtained by adding to the domestic value of government and private sector exports the absolute value of the price difference. The new totals in each row of the columns (24),(24'),(25),(26),(26') and (27) are shown in row 13 of Table .

There would also have to be a row (24') distinguished which in column (25) indicated government receipts of Egyptian pounds equal to the total price differences on government traded exports.

The next component of final demand is capital formation or final investment demands (columns 24 to 38) which is divided into private investment, the

investment corresponding to the three sectors of the government and foreign investment. However, in the present matrix, due to the unavailability of the necessary data, all investments are aggregated into a single category of total investment (column 40).

The last final demand vector is inventory investment or the change in stocks (DTS) in column 30.

Columns from 28 to 33 represent import tariffs, indirect taxes, direct taxes, and transfers. There are four rows that correspond to these columns. The final column, 40, is gross production of the sectors concerned. Each of these columns and the data included in them will be described subsequently.

After the rows for each of the first twelve producing sectors, row 13 of Block 1, the inter-industry flow matrix, represents the total inputs into the 12 sectors.

Row 14 represents gross value added of the twelve sectors concerned. It is disaggregated in rows 21 and 22. Row 21, though "household value added", actually represents the gross income of the household sector. Thus, this row includes both value added in the private sector and wages generated in the government and public sectors. Row 22 then represents just the surplus of public sector enterprises. Part of it is retained by the public sector, the other is transferred to the government. However, we treat it as one unit in Row 22 which corresponds to column 22 of the SAM.

Corresponding to the columns 15 to 20 which represent household consumption of the six socioeconomic classes, rows 15 to 21 represent the gross income of the households from each sector distributed among the six socioeconomic groups. Added to that in row 22 under column 26 there are remittances of Egyptians abroad which are treated here as a household export. This is also distributed among the five income classes and added to the gross income which appears in column 41 corresponding to rows 15 to 20.

Table 5

	Government Trade Domestic	Government Trade Exports	Price Differential	Private Sector Exports	Total Exports Domestic Prices	Total Ex F.O.B Price
	(24)	(24')	(25)	(26)	(26')	(27)
1	78	17	-17	0	17	34
2	26	2	- 4	49	51	55
3	0	100	-55	0	100	155
4				16	16	16
5				26	26	26
6				109	109	109
7				89	89	89
8				-	-	
9		49	-100	0	49	149
10				172	172	172
11						
12	42			171	171	171
TOTAL	146	168	-176	781	900	976
(24') Government Trade			+176			

Rows 23 and 24 represent the two rows corresponding to columns 23 and 24. Row 23 is conventional government revenue derived from import tariffs, indirect taxes, direct taxes and other revenues. The government trade row, 24, represents revenue from sales of intermediate goods by the government to producing sectors and sales directly to the household sector, box 24, 21, which is again distributed among the six socioeconomic classes. Row 24 also includes government direct sales abroad, i.e., government exports.

Row 23 and column 23 must balance and the balancing item is government deficit which appears in the box in row 36 column 23. An analogous balancing must occur with government trade purchases in column 24 and government trade sales in row 24: the balancing item in this case is government trade deficit, in the box in column 37 and row 24.

Row 27, represents total imports which are subdivided into rows 25 and 26. Row 25 represents government trade imports which are imports directly by the government. Imports in this row corresponding to columns 1 to 12 represent intermediate imports for the twelve sectors. They are treated here as non-competitive imports, i.e., as if none of them are producible domestically and so are not competitive with domestic production. There is also government trade imports directly to the household sector in row 24, column 21 which is again divided among the six income classes.

The second type of imports in row 26 are "other imports." These include: first, both public sector and household imports - imports in the row corresponding to columns 1 to 12 represent intermediate goods; second, direct imports to the household sector in the box in row 26, column 21, which is again divided among the six income classes as part of

their expenditure. Rows 28 to 32 represent types of government revenues. Thus, row 28 shows import tariffs paid by each of the twelve production sectors and tariffs paid by the household sector on its own imports. Row 29 contains indirect taxes considered as part of government revenues. These are also divided among the 12 production sectors. Column 21 in row 29 shows indirect taxes paid by the household sector on its own expenditure. This also has been divided among the six income classes.

Row 30 contains government subsidies. These go either to the production sectors which appear in the row corresponding to columns 1 to 12[3], or are paid directly to household sector. These affect the prices of the commodities sold directly to the household. The effect appears in row 30, column 21. This last item is again divided among the six socioeconomic classes in row 30, columns 15 to 20.

Row 31 represents government transfers considered from the revenue side and not the expenditure side. This includes the net contribution by households to the social security and pension funds in row 31, column 21. This item is again divided among the six income classes in row 31, columns 15 to 20. Row 32 represents direct taxes as revenue to the government. These include: Direct taxes paid by the production sectors 1 to 12, as, for example, the corporate tax; and direct taxes paid directly by the household sector, like wage tax, land tax etc. The latter appears in line 32 column 21. The last item is again divided among the six income classes, corresponding to columns from 15 to 29 in row 32.

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[3]For example, subsidies for the first four sectors are subsidies on fertilizers and pesticides, in sector five subsidies are on wheat flour and other items, etc.

Row 34 shows private savings which appear as figure corresponding to that row under column 21. This is divided among the six income classes. It appears as a balancing item between household income and household expenditure. Thus, the totals of rows 15 to 20 which represent the income accruing to the six income classes must balance with the totals of columns 15 to 20 which represent their expenditure. The balancing item is private savings whether positive or negative.

Row 35 represents government & public sector savings which is the surplus realized in government and public sector enterprises. Row 36 shows the deficit of conventional government which is the balancing item between conventional government revenue, and conventional government. Row 37 shows government trade deficit which is again the balancing item between sales and purchases. Row 38 shows foreign savings which represent the balancing item between total exports in column 27, and total imports, row 27.

Line 39 shows total savings which balances with the sum of column 40 of total investment. Total savings equals private savings plus government and public sector savings minus government conventional deficit minus government trade deficit plus foreign finance.

Row 41 shows gross production which corresponds to column 41 for the 12 sectors. Data in row 41, from columns 1-12, could be arrived at in this way. Gross production equals total inputs plus value added, plus imports, plus import tariffs, plus indirect taxes, minus subsidies.

4. The Input-Output Table for 1976.

The 12 X 12 input-output table for 1976 was based on the 1970/71 27 x 27 input-output table. It represents an aggregation of the latter table and then was transformed to fit 1976 final demand vector. It is necessary then to start with a brief description of the 1970/71 table before explaining how the 1976 table was developed.

The 1970/71 input-output table was constructed according to the rows methods and not by columns. This has been the methodology used since 1954, the earlier days of constructing these tables. The methodology was adopted because estimation of the input-output table depends on the data available from estimates of commodity balances of physical production.

The physical commodity balance estimates show, for each commodity, the balance between availabilities and uses. Availabilities are the sum: domestic production plus imports plus available stocks from previous periods. The total uses include intermediate consumption in the production process, final consumption demand, private and government, final investment demand, exports and finally changes in stocks. The estimates were carried out according to the commodity classification used in plan frameworks and prepared by a group of experts from the G.D.R.

The commodity balances were estimated for 171 commodities and commodity groups covering all economic activities. They include 41 agricultural

commodities and commodity groups, 171 industrial commodities and commodity groups, and 6 commodity groups which were difficult to disaggregate which include around 279 homogeneous commodities and commodity groups. It was difficult to get detailed information about intermediate inputs necessary for the production of these latter commodity groups. These six groups are:

1. Basic metallic industry
2. Metallic products industry
3. Production & repair of non-electrical machinery
4. Production & repair of electrical machinery
5. Production & repair of means of transport
6. Miscellaneous industries

As for the service sector, since there are no service "commodity" balances, the construction of the service rows depended on data available in the plan framework beside information available from different departments in the ministry of planning.

Given the information available and taking into account the type of service and its relative importance to economic activities, the aggregation of services in the table were made in the following manner:

1. Transport & Communication: includes rail road transport, water transport, both river and sea, air transport, road haulage and road transport, and postal, telegraphic and telephone service. Storage services and Suez Canal services were also included.

2. Other Services: include
   (1) Finance & Commerce
   (2) Banking & Insurance
   (3) Public Utilities

(4) Housing

(5) Tourism

(6) Other Services which include health service, educational services, etc.

To make the commodity balances data consistent with the needs of the input-output table, the data were consolidated according to the sectoral classification in the different plans and which reflect the structure of the Egyptian economy. In the process of aggregation, the agricultural sector was considered as an independent single sector irrespective of the different activities in agriculture. Industry was divided into 16 activities according to their commodity components. This is in addition to the above mentioned six activities which were aggregated on the basis of being homogeneous industries from the point of view of output. Industry is thus represented by 22 sectors or activities. A separate sector was reserved for each of the following: electricity, construction & maintenance, transport & communication, and other services.

The row for each of the 27 sectors indicated the flow of available resources to productive sectors generating intermediate demands, plus flows to final uses which differentiate between private and government consumption, exports, investment & change in stocks. The total of these flows represents available resources. To arrive at the value of imports received by the sector and which represents part of resource availability, gross domestic production was subtracted from total resource availability.

In the process of completing the rows of the table, the corresponding sectoral columns are formed. These are the 27 intermediate columns plus

the final demand vectors. The summation of the columns represents total inputs from local production and imports. By adding the value added generated in each sector, obtained from the national income accounts, we get the total production figure for that sector. The row and column sum must be identical for every sector. If there is any deviation in the estimation process, a process of rechecking starts to arrive at the source of deviation and the necessary corrections were made. After the formation of the table, the balance was tested using the following identity:

Value Added + Imports = Final Demand

The flows of the 1970/71 table were valued at 1969/70 prices using producer's prices. The producer's price for local production represents the value of product by the producer with farm delivery or factory door delivery. This includes cost of production plus tariff plus excise duties or commodity taxes minus subsidies. For imports, producer's price represents imports at c.i.f. plus customs duties.

Sources of the data

The source of data for physical production in the input-output table are the commodity balances after they were aggregated to the number and definition of the sectors in the table. The elements of the balances, uses and resources, are obtained from technical branches in the Ministry of Planning which represent all economic activities, i.e., production, consumption, exports and imports, etc. The technical branches, Departments, at the Ministry get their information from the production units, ministries, and organizations supervising certain economic activities. This information was obtained regularly, either directly or through responses to statistical

inquiries. From the same sources the information for service activities was obtained. The above sources were supplemented by historical data which is periodically published by the following agencies:

1. Central agency for Public Mobilization and Statistics (CAPMAS).
2. Annual and Quarterly Bulletin published by the Department of Economics, Ministry of Agriculture.
3. Price Reviews published by the Ministry of Supply and the Ministry of Industry. The importance of these reviews is to check the evolution of different mark-ups.
4. State Budget and Final Accounts - Ministry of Finance. For the estimation of public consumption, taxes and subsidies.
5. Monetary Budget for the estimation of exports and imports from the Central Bank of Egypt.
6. Nutritional Budget published by the Ministry of Agriculture. Used to estimate private consumption for some food items.
7. Studies and publications of various ministries and public departments concerning other activities and commodities.

The following are the commodity components of the 27 x 27 input-output table:

Sector No. I: Agriculture:

1. Cereal Group: wheat - barley - maize, millet, raw rice.
2. Pulses Group: beans, lentils, lupine, chickpeas, fenugreek.
3. Oil Seeds Group: flax seeds, ground nuts, sesame.
4. Sugar Cane
5. Fibre Group: cotton, flax, linen, jute.
6. Vegetables & Onion Group: vegetables and onion.
7. Other Crops: firewood.

8. Livestock Production: animal work, organic fertilizers, milk, live animals and birds for fresh meat, eggs, raw wool.
9. Honey
10. Fish, Sponges Hunting
11. Tea, Coffee, and Tobacco.

Sector No. 2: Ginning and Pressing: ginned cotton and cotton seeds.

Sector No. 3: Mining and Quarrying: extraction of coal, iron ores, manganese, other metal ores; extraction of rubble, sand, clay, and gravel; extraction of other non-metal products, phosphates salt, sulphur.

Sector No. 4: Crude Oil: crude oil and natural gas.

Sector No. 5: Food Processing Industry: Fresh meat, canned neat, intestinal parts, animal skin, canned fish and shells, dairy products, canned fruits and vegetables, wheat, maize and barley flours, ground beans and lentils, mill's leftovers, bread, biscuits, raw and refined sugar, createl, moulase, crystal sugar, pressing left-overs, cocoa butter, chocolate, sweets, margarine and synthetic fats, cotton seed oil, starches, other oils, glucose, sesame tahini, macaroni, cotton seed cakes for animal feed, other animal feed, ice, ground coffee, packed tea, ground spices, other items.

Sector No. 6: Beverages: Alcoholics, wines, beer and malt, soft drinks, other beverages.

Sector No. 7: Cigarettes, Cigars and Others: Include all tobacco products.

Sector No. 8: Spinning & Weaving: Cotton spinning, cotton textiles, wool spinning, woolen textiles, silk spinning, silk textiles, rugs and carpets, under-wear, tricot, socks, others.

Sector No. 9: Ready Made Cloth: Leather shoes of all kinds, ready made cloth and fashions, blankets.

Sector No. 10: Wood and Wood Products: Wooden furniture and wood tools, wooden doors and windows, meubles, others.

Sector No. 11: Paper and Paper Products: Paper paste, writing paper, wrapping and packing papers and containers, cardboard, flax paper, cigarette papers, papers for magazines and newspapers.

Sector No. 12: Printing & Publishing: Newspapers & magazines, books, others.

Sector No. 13: Leather and Leather Products: Tanned leather, leather products other than shoes.

Sector No. 14: Rubber and Rubber Products: Raw rubber, tires and rubber products.

Sector No. 15: Chemicals: Alcohols, sulphuric acid, caustic soda, sodium carbonate, phosphatic fertilizers, azot fertilizers, chlore and manufactured gases, detergents, drugs and pharmaceuticals, plastic products including artificial wool, cosmetics, paints and varnishes, matches, soap, glycerine, insecticides and pesticides, intermediate dying materials, photo films, heavy water, other chemical products.

Sector No. 16: Petroleum Products and Coal: Benzine, kerosene, solar, diesel, mazot, lubricating materials, coke, others.

Sector No. 17: Non-metallic Products: Bricks, flat glass, glass products, cement, cement product, ceramic and china, oven clay products, others.

Sector No. 18: Basic Metal Products.

Sector No. 19: Metal Products.

Sector No. 20: Non-Electrical Machinery and Equipment.

Sector No. 21: Electrical Machinery and Equipment.

Sector No. 22: Repair & Production of Means of Transport.

Sector No. 23: Miscellaneous Industries.

Sector No. 24: Electricity.

Sector No. 25: Construction: Construction and maintenance.

Sector No. 26: Transport, Communication & Storage: Rail-road transport, water transport (river - sea), air transport, road haulage, road transport, postal service, telegraphic & telephone services, storage, Suez Canal.

Sector No. 27: Other Services: Finance and commerce, banking and insurance, public utilities, health services, educational cultural and recreation services, ...etc., housing, tourism, others.

Comments on particular features of the Table

1) Public Consumption: These are the expenditures by the government and public administration on goods and services such as health, security, defense, education.

The expenditure by the armed forces on construction and its commodity components was considered as part of public consumption on the reasoning

that it has the nature of current expenditure rather than an increase in productive capital. This is different from the treatment of construction in other activities where such expenditures are considered capital formation. It should be noted here that health and educational services carried out by the private sector are considered to be within the production sectors, especially the service sector. This is different from government services which are considered as government expenditure since they do not depend on technical coefficients that govern other activities.

2) Private Consumption: This is consumption by households of goods and services. It has been estimated on the basis of commodity balances in addition to the data prepared by the Consumption Department in the Ministry of Planning. The conditions governing the consumption of every commodity were taken into account such as its income elasticity of demand, its exports, its storage, the size of population in each income group, and the patterns of consumption as revealed by the family budget survey. In certain cases when it was difficult to estimate the size of private consumption and due to absence of statistical data, it was estimated as the balancing factor between other uses and total availabilities.

3) Invisible Exports:

A) The value of invisible exports was added to the value of commodity exports in the 1970/71 plan. This was carried out according to the concept used in the national income account department in the ministry after excluding those items in invisibles which are considered as transfers since they lie outside the treatment of the flows in the table. The invisible exports include such items as insurance, shipping

revenues, interests and profits and 50 per cent of other revenues or incomes; the other 50 per cent of residual revenues were considered to be transfers.

B) The item of income received from residents working abroad includes savings of Egyptians working abroad. According to the national income accounts concepts (S.N.A.), Egyptians working abroad are considered as non-residents so long as their residence abroad extends beyond 6 months. These revenues are considered to be unrequited transfers and are not included in net factor income from abroad. Thus remittances are not included in N.I. accounts, and since the input-output table does not include any transfers; it lies outside its framework of accounting.

4) Invisible Imports: According to the concept of the National Income Account Department in the Ministry of Planning, invisible imports are added to commodity imports in both the commodity balances and 1970/71 plan frame according to the following rules:

- Value of imported cinema films are considered as imports services.
- Other commercial payments are added to imports of services.
- Payments for shipping are added to transport and communication service.
- For interest and profits and other payments, 90 per cent are considered as imports or services and the remainder as transfers.
- For tourism and transfers, 40 per cent are estimated to be tourist payments and the residual are considered as transfers.
- Government expenses abroad are all considered to be invisible imports since there is no detailed information about this item.
- For other international payments, 40 per cent are considered as services and the rest is treated as transfers.

The 1976 input-output table

In order to make the 27 x 27 1970/71 input-output table consistent with the 12 sector model used, three operations were carried out.

1) The restructuring of the 1970/71 input-output table to transform it into a 12 x 12 table.

This needed disaggregation of certain sectors and the aggregation of others to fit the new sectoral classification. It was also necessary to take into account types of production activities which had been created after 1970/71, such as the new steel complex, the aluminum complex and the reopening of the Suez Canal.

2) The transformation of values of the flows in 1970/71 table to 1976 prices by using index numbers of production.

The rows were multiplied by index number of prices and the columns by index number of quantities and the consistency of the results were checked.

3) Adjustment of the new 12 x 12 table at 1976 prices to be consistent with 1976 final demand vector as obtained from actual national income accounts.

This was carried out through the R.A.S. method which also included operation (2) above. The flow chart and the computer programme for this method are included at the end of this section.

The new sectoral classification

The model used puts special emphasis on agricultural activities. The agricultural sector was disaggregated into four sectors:

1. Staple Food
2. Non-staple Food
3. Cotton
4. Other Agriculture.

This detailed disaggregation required going back to the commodity balances and its flows at the commodity level to form a row for each of the four sectors. Moreover, information concerning inputs of goods and services to these sectors, available at the Agricultural Department in the Ministry of Planning, was used in the formation of the columns of these sectors. It was then possible to form the row and the column for each of these sectors.

Since the model pays special attention to cotton, making a separate row and column for that activity required the removal of the row and column by ginning and pressing in the 1970/71 table and its inclusion in the cotton sector in the new table. This was done for several reasons:

(1) The ginning and pressing operation is a very simple industrial process. It creates a relatively small amount of value added, most of which is wages.

(2) The exports of ginned cotton are considered as agricultural exports in international trade classification and have never been treated as industrial exports.

The following list presents the sectors of the new 12 by 12 input-output table and the commodities they constitute in comparison to the 27 by 27 sectors of the 1970/71 table.

Sector No. 1: Staple Food: wheat, barley, maize, millet, rice, beans, lentils, lupine, chickpeas, and fenugreeck.

Sector No. 2: Non-staple Foods: Flax seeds, ground nuts, sesame, sugar cane, vegetables and onions, fruits, milk, live animals and birds for fresh meat, eggs, honey, fish, hunting.

Sector No. 3: Cotton: Cotton, cotton seeds.

Sector No. 4: Other Agriculture: Linen, flax, jute, green fodders, raw wool, sponge, flowers, trees, other crops, firewood, animal work, organic fertilizers.

Sector No. 5: Food Processing Industries: Food processing, beverages, & tobacco and cigarettes. It includes sector (5), (6) and (7) in the old 1970/71 table.

Sector No. 6: Textile Industries: It includes sectors No. (8) and (9) in 1970/71 table.

Sector No. 7: Other Industries, Mining & Electricity: Include sectors, (3), (10), (11), (12), (13), (14), (15), (17), (18), (19), (20), (21), (22), (23), and (24) of 1970/71 input-output table.

Sector No. 8: Construction: It includes sector (25) of 1970/71 table.

Sector No. 9: Crude Oil and Products: It includes sectors (4) and (16) of 1970/71 input-output table.

Sector No. 10: Transport & Communication: It corresponds to sector (26) in 1970/71 table.

Sector No. 11: Housing: This sector was disaggregated from sector (27) of 1970/71 table and it includes housing services.

Sector No. 12: Services: Corresponds to sectors (27) of 1970/71 table excluding housing services.

The transformation to 1976 prices

The use of the new input-output table for the purposes of the model required the transformation of its flows as measured in 1970/71 prices as follows:

A) Price Index: A price index was constructed for each of the twelve sectors used in the table. It was weighted by the share of the commodities composing the sector in total value of output of the sector. To form this index, information concerning prices and quantities in 1970/71 and 1976 for the commodities used in forming this index was required. The index used was as follows:

$$\frac{\sum \left[\frac{p\ (76)}{p\ (70/71)}\right] p\ (70/71) \cdot q\ (70/71)}{\sum p\ (70/71) \cdot q\ (70/71)} \cdot 100$$

B) The Quantity Index: A simple quantity index was formed by dividing commodities and groups of commodities used in forming the price index for 1976 by the same quantities in 1970/71 ,

$$\sum \left[\frac{q\ (76)}{q\ (70/71)} \cdot 100\right]$$

The commodities used in forming the price index in every sector were as follows:

Sector No. 1: Staple Food: Wheat, maize, raw rice, beans, lentils.

Sector No. 2: Non-Staple Food: Sugar cane, vegetables, onions, fruits, milk, eggs, live animals and birds for fresh meat.

Sector No. 3: Cotton: Cotton including exports.

Sector No. 4: Other Agriculture: Green fodder.

Sector No. 5: Food Processing Industries: Fresh meat, threshed rice, raw and refined sugar, edible oil, white cheese, wheat flour, maize flour.

Sector No. 6: Textiles: Cotton fibers, cotton textiles, wool fibers, woolen textiles, synthetic fibers, silk fibers, silk textiles, ready-made cloth.

Sector No. 7: Other Industries: Iron ore, raw manganese, table salt, cement, azot fertilizers, nails, tanned leather, reinforcing bars, paper paste, writing paper, magazine papers, buses, trucks, tractors, television sets, electricity.

Sector No. 8: Construction: Cement, reinforcing bars, flat glass, wooden doors and windows.

Sector No. 9: Crude Oil & Products: Crude oil, benzine, kerosene, solar diesel, mazot, coke.

Sector No. 10: Transport and Communication: Railroad transport (passengers - commodities), road transport (passengers - commodities), water transport (passengers - commodities).

Sector No. 11: Housing: Housing services (income).

Sector No. 12: Other Services: Finance and commerce, education, health, tourism.

The resulting price and quantity indices for the twelve sectors are as follows:

		P. index	Q. index
1.	Staple Food	155	106
2.	Non-Staple Food	223	132
3.	Cotton	166	73
4.	Other Agriculture	193	127
5.	Food Processing	135	135
6.	Textiles	129	140
7.	Other Industries	144	135
8.	Construction	163	160
9.	Crude Oil & Products	332	130
10.	Transport & Communication	197	116
11.	Housing	107	107
12.	Other Services	148	130

The following operations were carried out to multiply rows by price indices:

$$x_{11}\,p_1 \quad x_{12}\,p_1 \cdots\cdots x_{1.12}\,p_1$$
$$x_{21}\,p_1 \quad x_{22}\,p_2 \cdots\cdots x_{2,12}\,p_2$$
$$\vdots$$
$$x_{12,1}\,p_{12} \cdots\cdots x_{12,12}\,p_{12}$$

The second operation is to multiply columns by quantity indices

$$(x_{11}\,p_1)\,Q_1 \quad (x_{12}\,p_1)\,Q_2 \cdots\cdots (x_{12}\,p_1)\,Q_{12}$$
$$\vdots$$
$$(x_{12,1}\,p_{12})\,Q_1 \cdots\cdots (x_{12,12}\,p_{12})\,Q_{12}$$

To use the R.A.S. method to carry out the price transformation and to check it, it is necessary to calculate intermediate demand, ID, for

1976, in order to check the summation of the rows after price corrections. Moreover, total inputs, TI, for 1976 must be calculated to check the summation of the columns. Intermediate demands were obtained by subtracting final demands, FD, for every sector from total output of that sector. I.e.:

$$ID_1 = Q_1 - FD_1 \quad ;$$
$$ID_2 + Q_2 - FD_2 \quad .$$

The total inputs were estimated by subtracting value added, VA, from total output:

$$TI_1 = Q_1 - VA_1$$
$$TI_2 + Q_2 - VA_2$$

The RAS method was used on the matrix. It was required that:

$$x_{11}^{(0)} + x_{12}^{(0)} \ldots\ldots\ldots\ldots + x_{1,12}^{(0)} = \overline{ID}_1 \quad ;$$

$$x_{21}^{(0)} + x_{22}^{(0)} \ldots\ldots\ldots\ldots + x_{2,12}^{(0)} = \overline{ID}_2 \quad .$$

and so on.

In addition:

$$\begin{array}{ll} x_{11} & x_{1,12} \\ + & + \\ x_{21} & x_{2,12} \\ x_{31} & \cdot \\ \cdot & \cdot \\ \cdot & \cdot \\ \underline{x_{12,1}} & \underline{x_{12,12}} \\ TI_1 & TI_1 \end{array}$$

The price and quantity transformation was checked by means of the following:

$$C = \frac{\sum_{i=1}^{12}\left(\sum_{j=1}^{12} x_{ij} - DI\right) + \sum_{j=1}^{12}\left(\sum_{i=1}^{12} x_{ij} - TI\right)^2}{\sum_{i=1}^{12} DI^2 - \sum_{j=1}^{12} TI^2}$$

$$\text{So that } C \leqslant 10^{-6}$$

The matrix was then corrected through the R.A.S. to fit the final demand and total inputs in 1976. The corrective factors were for the rows:

$$\gamma_i = DI_i \Big/ \sum_{j=1}^{12} x_{i,j}$$

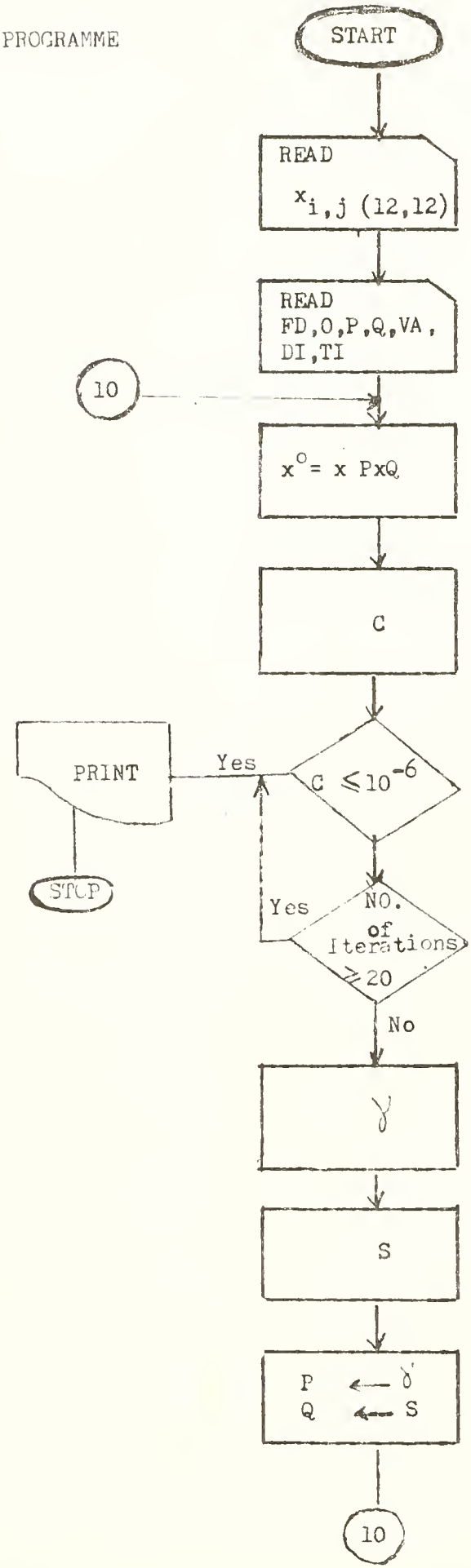
and for columns

$$S_j = TI_j \Big/ \sum_{i=1}^{12} x_{i,j}$$

where i = 1,2.....12.
j = 1,2,.....12.

The new table is found in the S.A.M. in the north eastern block.

FLOW OF RAS PROGRAMME



$$C = \frac{\sum_{i=1}^{12}\left(\sum_{j=1}^{12} x_{i,j} - DI\right)^2 + \sum_{j=1}^{12}\left(\sum_{i=1}^{12} x_{i,j} - TI\right)^2}{\sum_{i=1}^{12} DI^2 - \sum_{j=1}^{12} TI^2}$$

, $\gamma_i = D_i / \sum_{j=1}^{12} x_{i,j}$

$S_j = TI_j / \sum_{i=1}^{12} x_{i,j}$

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(edited by R. S. Eckaus)
January 9, 1979

5. Government Expenditure

The model divides government activities into three distinct sectors: G_1, conventional production in the public sector, G_2, conventional governmental activities and G_3 the government trading activity. These sectors are reflected in SAM in three rows, 22, 23, and 24, and columns 22, 23 and 24. The columns refer to purchases or expenditures, while the rows refer to revenue or sales.

Government Sector 1 (G_1)

This sector refers to public sector production activities, i.e., those carried on by government firms, but includes only the surplus created in the public sector which is used to finance capital formation in both government proper and the public sector. The intermediate inputs and outputs of this sector and deliveries to final uses are included in production sector activities. The surplus created in the public sector is part of national savings. Row 22 includes the surpluses of all public and government activities. The data in this row is obtained from both the National Income Accounts Department of the Ministry of Planning and the Department of Industry. The latter has data on value added by industry divided by its origin in the private and public sectors. These figures were aggregated into the twelve sector classification. Moreover, data on wages by sector and activity were obtained from the same sources.[1] The wages in the public sector by activitywere subtracted from value added in that

[1] The Follow-up Report of 1976 presents data on wages in 8 sectors. These were complemented by data from the Department of Industry on wages in the public sector by industry or activity.

sector or activity. This generated the estimate of the surplus in public sector firms classified in each of the 12 sectors in rows 22 in SAM. Part of the surplus generated in the public sector is transferred to general government funds to be used for financing government investment. The ratio of surplus transferred is usually 65%, yet it differs somewhat according to the sector. The residual part is kept by the public sector firms to finance part of their investment, particularly replacement and renewal. The transfer of the surplus from the public sector to the government is not shown in SAM. The total surplus generated is treated as one unit, since both the part transferred or that which remains within the public sector are used to finance capital formation by government, whether conventional government or the government production sectors.

Since row 22 includes all of government savings, the net surplus of the social security and pensions funds were added in row 22, column 31. This is the net surplus after government payment of its commitments. The magnitude of this surplus is 296 (M.L.E.). This amount could also be looked at as a transfer from the household sector to the government sector. That is why it is located under column 31 which includes government transfers. The total of row 22 is 1,414 (M.L.E.) in 1976. The entry in row 35, column 22 includes only the one amount of 1,414 (M.L.E.).

Government Sector 2, (G_2)

The second government sector, termed conventional government, is concerned with traditional activities of the government: health, education, defense and security, etc.. This part of government activities is located in SAM in row and column 23. The row represents traditional government revenues and the column traditional government expenditures. The sources of traditional revenue, row 23,

are import tariffs, row 23, column 28, indirect taxes, row 22, column 29, and direct taxes, row 23, column 32. The amounts of these three items are 477 (M.L.E.), 469 (M.L.E.) and 378 (M.L.E.) respectively. The total revenue of the conventional government sector is 1,324 (M.L.E.). The sources for these figures were both from the Follow-up Report of the year 1976. Ministry of Planning and the State Budget for 1976, Ministry of Finance Vol. II.

The conventional government column 23 includes the government's final consumption demands. The data were obtained from the N.I. Accounts Department of the Ministry of Planning. The data were provided originally in 8 sectors and were disaggregated into the 12 sector classification. The government final consumption demand includes government current expenditure on goods and services. The original data were as follows:

	M.L.E.
Sector 1	14
Sector 2	60
Sector 3	-
Sector 4	-
Sector 5	50
Sector 6	27
Sector 7	268
Sector 8	-
Sector 9	35
Sector 10	100
Sector 11	4
Sector 12	1,013
Total	1,571

The conventional government column also includes conventional government's expenditure on subsidies, 146 (M.L.E.). These subsidies included in conventional expenditure are different from subsidies in government trading activities. With total conventional government expenditure of 1,717 (M.L.E.) and conventional revenues of 1,324 (M.L.E.) the deficit of the conventional government sector is 393(M.L.E.), which is located in SAM in row 36, column 23.

Government Sector 3, (G_3)

The government trading sector appears in SAM in row and column 24. In its trading activities the government buys and sells a variety of goods in a number of alternative arrangements. The government may buy all or part of the output of one sector and resell it to other sectors as intermediate inputs, or it might sell it directly to the household sector. The government might buy output from some sectors and sell that output abroad as exports. Moreover, part of the government purchases might be from abroad in the form of imports. The latter might, in turn, be sold to the producing sectors as inputs or they might be sold directly to households. For example, wheat flour is imported directly by the government and sold to bakeries in the food processing industries. Frozen meat and poultry are imported directly by the government and sold directly to households. Purchases from the local producing sectors like sesam is sold to sector 5, food processing. Beans are bought from sector 1, staple food, and also sold directly to the household sector.

The trading activities by the government involve profits and losses of both which have distributive effects. When losses are incurred, then the government, in effect, is paying a subsidy. This represents the difference between the purchase price and the selling price. The redistributive effect depends on who receives the subsidy. When the government realizes profits on its trading activities, that results in revenues to the treasury.

Since the model used focuses attention on the effects of the price and subsidy policies of the government, as well as other policies, the segregation of the government trading activities is of vital importance. Generally, the government trading activities are carried out by the General Supply Authority. However, there are a few trading activities carried out by the government outside the

domain of the General Supply Authority. The most important of these latter activities are the purchase of cotton from sector 3 and selling it to sector 6 and to exports.

The examination of the government trading activities in 1976 shows total purchases of 1,012 (M. L.E.). Total sales were equal to 623 (M. L.E.). The total deficit in that sector was 389 (M. L.E.) which represents the net subsidies paid by the government in carrying out these activities. The following table represents the purchases and sales by the General Supply Authority.

Purchases & Sales

by the General Supply

Authority

1976 (1,000's of L.E.)

	Item	Purchase	Sale	Profit or Loss
1	Wheat	274,711	149,449	- 152,262
2	Fine Flour	78,355	52,574	- 25,781
3	Maize	49,640	26,566	- 23,074
4	Beans (horse)	22,145	16,185	- 5,959
5	Row Rice	40,000	40,000	------
6	Lentils	16,654	7,647	- 9,007
7	Sesam	11,156	10,729	- 427
8	Dry Beans	1,335	1,351	+ 16
9	Edible Oils	60,953	19,992	- 40,961
10	Fats (animal)	39,608	23,160	- 16,448
11	Frozen Meat	19,024	27,695	+ 8,171
12	Frozen Chicken	12,155	12,155	-----
13	Fresh Meat	3,090	3,090	-----
14	Live Cows	6,300	6,352	+ 52
15	Live Sheep	521	508	- 13
16	Live Camels	4,875	4,875	-----
17	Imported Sugar	40,317	37,287	- 3,030
18	Tea	30,975	45,169	+ 14,194
19	Coffee	7,247	3,934	- 3,313
20	Other Products	22,145	44,504	+ 2,359
21	Otner Supply Losses	42,707	-----	- 42,707
	Total	803,913	533,216	- 270,697

Source: General Supply Authority 1976. The other supply products in item 20 include forexample, dry milk, cheese, frozen fish and canned fish, etc. Item 21 represents losses on services purchased by the Authority to carry out its activities. This is apart from other current and transfer expenses by the Authority as commissions, transport, customs.

The preceding table shows the purchase and sales by the General Supply Authority. In addition, there are local procurements carried out by the government from domestic sectors as well as some purchases carried out from abroad.

The example of the first is cotton where there is compulsory delivery by the cotton growers. The same system applies to 50% of the onions cultivated in Upper Egypt. It applies also to rice, and was formerly applied to beans and sugar cane in areas where sugar is manufactured. Examples of the second type of goods are fertilizers and pesticides, since local capacity is not sufficient to satisfy the local demand. Moreover, the purchases that appear in the above table could be divided into domestic trade in beans, lentils, etc., while other items include imports like wheat, flour, maize, frozen meat.

The data in the above table were aggregated to represent purchases from the production sectors. For example, in sector 1, procurement of rice[2], beans and lentils totals 95 (M.L.E.). In sector 2, the procurement of sesam and fresh meat is 28 (M.L.E.). In sector 3, the procurement of cotton is 100 (M.L.E.). The cotton is sold in the export market and the government realizes a profit in the form of price differentials of 55 (M.L.E.). The procurement price is 30 L.E. per cantar, on the average, while export price is equal to 46 L.E.

In sector 12, the purchases of services to carry out the activities is 42 (M.L.E.). Other purchases and sales in the government trading sector are grouped and located in front of row 24, column 24. The other item in the column of government trade is 368 (M.L.E.) which represents the total subsidies paid on the government trade activities. This represents the 270 (M.L.E.)

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[2]The figure for rice in the table is 40 (M.L.E.) by the authority the actual procurement is 57 (M.L.E.) the 17 is procurement for rice export.

plus 98 (M.L.E.) paid on other items outside the General Authority. It should be noted that the cotton procurement in the column represents that part which was exported. The other part of the cotton production appears in the input-output table as deliveries from sector 3 to other sectors as intermediate.

Row 24 represents sales or receipts of the government trading sector. These are divided into sales to other sectors and sales directly to households. The 25 (M.L.E.) in column 5 represents the sales of sesam to the food processing sector. The other sales are directly to households of 79 (M.L.E.). These include sales of beans, lentils, fresh meat, sugar, and other commodities to ration shops. The 79 (M.L.E.) of sales to households is distributed among the six income classes on the basis of three criteria: the ratio of the expenditure of each income class to total expenditures, the types of commodities sold and the income elasticity of demand for those commodities.

The third type of item in row 24 is government receipts from trade in imported goods. The details of this item will appear in row 25 which is concerned with government trade imports. The last item in row 24 is 119 (M.L.E.) which represents 119 (M.L.E.) government receipts from trade export, (100 + 2 + 17) plus 21 (M.L.E.) as indirect taxes on government trade activities. The total of row is 1,012 (M.L.E.). The balancing item for the sums of row 24 and column 24 is the deficit on the government activities which is -389 (M.L.E.).

Row 25 tabulates government trade imports. There are items imported directly by the government for sale either to the production sectors as intermediates or sold directly to the household. Government intermediate imports are equal to 552 (M.L.E.). These include imported fertilizers and pesticides sold to the four agricultural sectors (1,...,4) and goods sold to food processing

sectors like wheat, flour, live animals, etc. Direct imports by the government for the household sector are 216 (M.L.E.) which are also distributed among the six income classes. The total of government trade imports is 768 (M.L.E.). Since this line deals with imported items, it is explained in detail in the section on exports and imports.

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6. Taxes and Subsidies

The tax and subsidy elements in SAM deal with the government fiscal system and policies. These are recorded in rows and columns 28, 29, 30 and 32. Row 28 deals with import tariffs, row 29 with indirect taxes, row 30 with subsidies, and row 32 with direct taxation. Each of these items is distributed in three major parts. The first part is related to the twelve producing sectors and distributed among them. The second part is concerned with the household sector and distributed among the six income groups.

Row 28, as mentioned before, deals with import tariffs. In 1976, tariffs on imports were equal to 447 million L.E. The data for import tariffs were obtained from several different sources: the state budget for 1976, Ministry of Finance, Vol. II; the Budget Department, Ministry of Planning and the customs books which show the tariffs on detailed imported items. With respect to the aggregate figures, there were some discrepancies between figures in 1976 Follow-up Report, the state budget and the data from the Budget Department. The discrepancies are in the order of 17 million L.E. The detailed data were as follows:

CUSTOMS DUTIES ON IMPORTED

ITEMS 1976 Million L.E.

1-	Wheat	7.8
2-	Fine Flour	5.2
3-	Maize	1.6
4-	Pulses	0.7
5-	Coffee	2.6
6-	Tea	9.3
7-	Fruits	1.7
8-	Live Animals	--
9-	Fresh and Canned meat	3.8
10-	Dairy Products	3.7
11-	Food Oils	4.1
12-	Raw & Refined Sugar	16.2
13-	Cigarettes	--
14-	Beer	--
15-	Wine	--
16-	Soft Drinks	--
17-	Other Food Products	3.2
18-	Soap	--
19-	Pharmaceuticals	1.5
20-	Cloth & Blankets	--
21-	Passenger Cars	52.8
22-	Refrigerators	--
23-	Television Sets	--
24-	Washing Machines	--
25-	Cookers	--
26-	Other Consumer Goods	4.0
27-	Oil Seeds	0.4
28-	Raw Jute	0.5
29-	Vegetable Seeds	1.5
30-	Raw Wool	1.2
31-	Tobacco	157.1
32-	Other Crops	4.9
33-	Coke Coal	3.3
34-	Mineral Raw Material	0.9
35-	Cement	--
36-	Other Raw Materials	2.0
37-	Chemical Products	25.5
38-	Lubricants Oil	--
39-	Fertilizers	--
40-	Leather & Products	0.4
41-	Textiles (cotton, wool)	13.4
42-	Paper Paste	11.5
43-	Rubber	5.0
44-	Basic Metallic products	15.4
45-	Metallic Products	11.1
46-	Reinforcing Bars	--
47-	Non-electric Machines	28.6
48-	Electrical Machinery	9.6
49-	Means of Transport	29.2
50-	Other Machinery	17.0
51-	Crude Oil	1.6
52-	Intermediates for Petroleum Sector	3.2
53-	Wood Products	7.5
54-	Non-Metallic Products	5.1
55-	Other Products	3.5
	Total	477.6

The above data were aggregated and reclassified to fit the three major import divisions. These are: the twelve producing sectors, the household sector with the six divisions of income groups and the capital goods imports. The tariffs paid by the household sector were distributed among the six income groups. For the method of distribution, see chapter on distribution of expenditure.

Row 29 deals with indirect taxes. The sources of data for this line were again the Follow-up Report of 1976, Ministry of Planning, the state budget for 1976, Vol. II, and the data available to the Budget Department in the Ministry of Planning. The three sources diverge in their estimates of indirect taxes. However, the divergence is too small to effect modelling results. Total indirect taxes in 1976 are roughly equal to 490 million L.E., This is divided into 340 million L.E. paid by the 12 producing sectors and 150 million L.E. paid directly by the household sector. Indirect taxes are divided into excise duties, 71.1 million L.E., commodity taxes, 8.3 million L.E., consumption taxes (duties), 10.1 million L.E., price differences, 185.5 million L.E., royalties, 25 million L.E., recreation tax 5 million L.E., and other taxes and duties, 185 million L.E. The detailed breakdown of all these taxes and duties was available only for excise duties, price differences, and consumption duties on some imported items.

Each one of these taxes was investigated to determine which are paid by the producing sectors and which are paid by the household sector. Generally, price differences and consumption taxes are paid by the household sector, while excise duties and other indirect taxes are paid by the producing sectors. The detailed breakdown of the excise duties and other indirect taxes were aggregated and distributed among the twelve producing sectors. When information

was lacking, the taxes were distributed among the producing sectors. according to value added. The indirect taxes paid by the household sector were distributed among the six socio-economic classes. The distribution was carried out according to the ratio of expenditure of each class to total expenditure by the six classes.

Row 30 deals with subsidies. In 1976, total subsidies were 514 million. The sources of data for the subsidies were the data available at the General Supply Authority, the state budget, the Ministry of Finance Vol. II, the data available at the Budget Department, Ministry of Planning. The data available indicated the breakdown of subsidies as follows:

SUBSIDIES ON FOOD ITEMS

1976

(GENERAL SUPPLY AUTHORITY)

	Commodity	Subsidy
1-	Wheat	152,262
2-	Flour	25,781
3-	Maize	23,074
4-	Beans	5,959
5-	Lentils	9,007
6-	Sesam	0.427
7-	Edible Oils	40.961
8-	Fats	16,448
9-	Live Cows	0.052
10-	Live Sheep	0.013
11-	Imported Sugar	3,030
12-	Coffee	3,313
13-	Other Supply Losses	42,707
	Total	323,034

There are other types of subsidies which lie outside the domain of the General Supply Authority, but still are included in the budget. These are:

OTHER SUBSIDIES

1976

(1,000 L.E.)

	Sector	Subsidy
1-	Organization for Cooperative Building	0.190
2-	Organization for Public Transport (Cairo)	10,570
3-	Organization for Public Transport (Alex)	0.549
4-	Petroleum Companies	7.213
5-	Popular Cloth	36,637
6-	Fund for Balancing Agricultural prices	40,568
7-	Cotton Sold to the Spinning & Weaving	50,000
8-	Paper for the Daily Newspapers	4,000
9-	Other Subsidies	41,000
	Total	190,727

Total subsidies total 513.76 million L.E. These were divided into those paid to the producing sectors and those paid directly to the household sector. The subsidies that were paid to the producing sectors were allocated to each of the 12 producing sectors according to the commodity classification in the above two tables. The subsidies paid to the household sectors were distributed among the six socio-economic groups. The distribution was carried out according to the ratio of expenditure of each group on commodities of sectors 1 , 2, 5 and 6 to total expenditure of the six groups on the output of these sectors. In this way, the subsidies received by each of the six income classes were estimated.

Row 32 deals with direct taxation. This was the item for which there was least information. There was no detailed breakdown of direct taxes paid by sector. Moreover, it was not possible, to know the nature of some of the local, direct taxes. The sources of data were the state budget 1976, Vol. II, and information available at the Budget Department of the Ministry of Planning and the Follow-up Report of 1976 by the Ministry of Planning. The total direct taxes in 1976 were 378 million L.E.

The first task was to divide direct taxes into those paid by the 12 producing sectors and those paid by households. Taxes paid by the 12 producing sectors are corporate taxes and other taxes associated with it like defense and national security taxes paid by the business sector, besides a few small taxes. The taxes paid by the household sector were labour income or wage tax and national security and defense taxes associated with it, the liberal professions income tax, general income tax, property tax, estate duties, inheritance tax, land tax, stamp tax, and other local taxes and duties.

The direct taxes paid by the twelve producing sectors, corporate taxes, were distributed among the sectors according to the ratio of value added of that sector to gross value added. However, the sectors chosen for the allocation of direct taxes were not all of the twelve producing sectors, but were those sectors which have large corporations which are capable of paying the corporate tax.

The direct taxes paid by the household sector were allocated among the six income groups according to these rules:

1) The liberal professions' income tax was allocated to the top ten percent of income recipients in urban areas. The general income

tax was allocated to the top ten percent in urban and rural areas with the ratio of 2:1.

2) The inheritance tax was distributed among the top ten percent income groups in rural and urban areas equally.

3) The wage income tax was assumed to be paid only by income groups in urban areas where there is organized business. The share of wages in the income of the three urban income classes was calculated. The wage tax was distributed according to the ratio of wages in each income group to the total wage income in urban areas.

4) The land tax was assumed to be paid only by income groups in rural areas and was distributed according to the distribution of land among the three rural income classes.

5) The property tax was assumed to be paid by urban income groups and was allocated by the ratios of 50 percent, 30 percent, 10 percent to the top ten percent, the middle thirty percent and the lowest sixty percent of income recipients.

6) Other taxes were distributed according to the share of income.

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7. Exports and Imports

The export and import balance is reflected in SAM in rows and columns 25 to 27. The disaggregation of the export-import accounts into three rows and columns was carried out with the aim of identifying the role of the government in foreign trade. The model focuses attention on the government as a trader and on government trading activities by identifying them in row and column 24. However, government trading activities are not confined only to internal trade, but extend into the field of international trade. The sales and purchases of the General Supply Authority include many items imported directly by the government. However, government imports are not confined to those of the General Supply Authority. Other government agencies import items such as fertilizers, pesticides, cement etc. These imported items can be sold to the producing sectors as intermediate goods or to the household sector as consumer goods. In the trade of imported goods, the government realizes a profit, as in the case of tea, or incurs a loss, as for wheat & flour. In the latter case, the treasury pays a subsidy.

On the export side, there exists a system of compulsory deliveries for certain agricultural crops such as cotton, rice, onions and sugar cane. This system is complemented by a monopoly of the government in the export of some of these items. This monopoly allows the government to realize profits on the export of these items in the form of price differentials which are the differences between the compulsory delivery prices paid to the farmer and the export prices. This system requires that the export column be divided into exports at delivered prices, price differentials and total exports, at foreign selling prices, column 25, 26 and 27 in SAM.

The data on final export demand as part of the final demand vector in SAM were obtained from the National Income Accounts Department of the Ministry of Planning. The data were originally classified in eight sectors and were disaggregated to fit the 12 sector classsification of SAM. The data were also checked with the figures for exports in the 1976 Follow-up Report of the Ministry of Planning. The original final export demand data for 1976 was as follows:

FINAL EXPORT DEMAND

1976

(Million L.E.)

1-	Staple Food	34
2-	Non-staple Food	55
3-	Cotton	155
4-	Other Agriculture	16
5-	Food Processing	26
6-	Textiles	109
7-	Other Industries	89
8-	Construction	--
9-	Crude Oil and Products	149
10-	Transport & Communication	172
11-	Housing	--
12-	Other Services	171
	Total	976

This column was then divided into two columns: price differentials, and exports at delivered prices. This led to the investigation of price formation and pricing policies of different agricultural and industrial goods to locate and estimate the price differentials. For rice, in sector 1, the value of the amount procured for export at delivery prices is 17 Million L.E. while the price differential is 17 million L.E. Thus the total value of rice exports is 34 million L.E. In sector 3 the compulsory delivery price of cotton is L.E. 32 per cantar, while the export price per cantar is L.E. 46. The price differential in this case totals 55 million L.E., while the value of farm purchases was equal to 100 million L.E. Total exports of cotton are then 155 million L.E. Onions, in sector 2 are bought at value of 2 million L.E. and exported for 6 million L.E., so the price differential is 4 million L.E. The last item is crude oil. Total exports are 149 million L.E., while the price differential is 100 million L.E.

The export final demand column was, therefore, divided into the following columns:

EXPORT FINAL DEMAND

1976 Million L.E.

Sector	Price Differential	Exports at Delivered Prices	Total Exports at Selling Prices
1- Staple Food	17	--	17
2- Non-staple Food	4	49	53
3- Cotton	55	--	55
4- Other Agriculture	--	16	16
5- Food Processing	--	26	26
6- Textiles	--	109	109
7- Other Industries	--	89	89
8- Construction	--	--	--
9- Crude Oil and Products	100	49	149
10- Transport and Communication	--	172	172
11- Housing	--	--	--
12- Other Services	--	171	171
Total	176	681	857

The remaining two items in the export column are worker remittances and foreign capital inflows or foreign savings. The accounting practice for workers' remittances in Egypt as in other countries, is to keep them outside of the national income accounts system. They are not considered as part of net factor income from abroad. This practice is justified by the practice of considering any Egyptian who stays abroad for over six months as a non-resident. Hence, his remittances are looked at as transfers. Workers' remittances are treated differently in SAM. They are considered to be factor incomes earned abroad, i.e., as exports from the household sector. Thus the 310 million L.E. of worker's remittances were put in SAM in colum 26 in row 21 of household value added. This household export was also distributed among the six income classes.

The last item in the export column is the capital inflow of 654 million L.E. This is located in column 27, row 38 for foreign savings. The capital inflow is the balancing item for net imports. It is taken from the Follow-up Report for 1976.

Imports are divided into three rows 25, 26, and 27. These are government trade imports, other imports, and total imports. Data on imports are from the Follow-up Report of 1976 by the Ministry of Planning. Detailed data on trade statistics are from the Department of Foreign Trade in the same ministry. The final source if the General Supply Authority statistics which were referred to previously in the note on the government sectors.

Row 25 refers to government trade imports. These are items imported directly by the government. These imports can either be sold to the producing sectors as inputs of directly to the household sector. The first group includes fertilizers and pesticides which are sold to the agricultural sectors. Wheat, part of maize imports and part of flour imports, are sold to sector five as

inputs. Government intermediate imports, row 25, is 552 million L.E. The government imports for the household sector total 216 million L.E. These are items, mostly imported by the General Supply Authority, like fats, edible oil, frozen meat, frozen fish and poultry, tea, coffee, sugar, etc., as was noted before in discussing government trade activities.

The government imports to the household sector were divided among the six income groups. The criteria for distribution were the ratios of income of each class to total income, the nature of the commodities imported, and the income elasticity of demand for each income class. Total government imports are 768 million L.E. which represent 39.5 percent of total imports.

Row 26 deals with other imports. This represents imports by the public sector production units to satisfy their needs for intermediate imports. These intermediate imports are 656 million L.E. The source of data for these imports are the Follow-up Report, trade statistics of the Foreign Trade Department of the Ministry of Planning and CAPMAS trade statistics. These data on imports were grouped and classified according to the 12 sector classification. The second item in row 26 is household direct imports which are equal to 125 million L.E. and appear in row 26 and column 21. These are items imported directly by households including consumer durables like television sets, radios, refrigerators, private motor cars, etc. Household consumer imports were distributed among the six income groups. In the distribution of these imports among the six income groups, the 1974/75 family budget survey was relied upon. The method of calculating these imports and how they are distributed among the six income classes can be found in the chapter on distribution of income and expenditure. Household imports are represented in sector 13 in that chapter.

The third item in row 26 which deals with other imports is related to imports of capital goods which, in 1976, were equal to 391 million L.E. These are located in row 26, column 36 which deals with investment final demand. The total of row 26 is 1172 million L.E.

Row 27 deals with total imports. This represents the summation of rows 25 and 26. They are in turn divided into three sections. Part one deals with intermediate imports. These are imports of inputs to be used by the producing sectors and are allocated among the 12 sectors in SAM. Total intermediate imports are equal to 1208 million L.E. The second section of row 27 deals with household imports of consumer goods. This is equal to 341 million L.E. which represents imports of consumer goods by the government for households of 216 million L.E. or direct household imports 125 million L.E. These are located in row 27, column 21. Both these items are distributed among the six income classes. The third section deals with capital goods imports. These appear in row 27, column 40 which deals with total investment. Total imports are then 1940 million L.E. Imports are valued at CIF prices. This is made quite clear in SAM, since row 28 deals with import tariffs.

With total imports of 1940 million L.E. and total exports equal to 1286 million L.E., balancing item, capital inflows are 654 million L.E. which appear in column 27 row 38.

8. The Distribution of Income and Expenditure.

1. Introduction

To arrive at an estimation of income distribution in Egypt it was first necessary to distinguish the income classes among which the income is to be distributed. It was decided that it is most appropriate for Egyptian conditions to divide the society into six income classes, three rural and three urban. In both cases they represent lowest 60%, middle 30%, and top 10%. This division was preferred to two other widely used divisions: (1) the lowest 80% and top 20%, and (2) the lowest 40%, middle 40%, and top 20%. The first division combines heterogeneous socio-economic groups into a single unit, while the latter disguises to great extent the skewness in the pattern of income distribution.

To arrive at the distribution of income among the six socio-economic classes two types of information were needed:

(1) The factor shares in value added of both the public and private sector.

The income earned in the public sector was divided generally into two types of factor shares, labor and capital, in order to obtain the share of public labor and share of public capital, SBL and SBK, respectively. In the private sector, value added in the first four agricultural sectors was divided into three shares, i.e., the share of labor, the share of capital, and the share of rent. Private value added in the other private sectors was divided only into the two shares, labor and capital.

(2) The second step is to estimate the share of each of the six income classes in the three types of factor shares of the private sector and in the share of labor in the public sector, public wages. The share of each class into the different factor shares was denotated as $SSPL_{ik}$, $SSPK_{ik}$, $SSPT_{ik}$, $SSGL_{ik}$. k indexes the income classes from 1 to 6; i is the productive sector concerned; P refers to private activity in sector i and G to government activity.

Thus, the income received by each of the six classes will equal:

$$YH_k = \sum_{i=1}^{12} HM_i \left[SPL_i * SSPL_k + SPK_i * SSPK_k + SPT_i(I) * SSPT_k \right] + GM_i \left[SGL_i * SSGL_k \right] + RM \left[SRM_k \right] ;$$

where

YH_k = gross income of class k;

HM_i = private value added of sector;

GM_i = government value added of $sector_i$;

RM = remittances from Egyptian workers abroad;

SRM_k = the share of that class in workers remittances.

2. The estimation of value added and household income by producing sector

To arrive at the distribution of income among the six classes we had to estimate gross household income. This was defined in our study as value

added generated in the private sector plus wages generated in both the government and the public sector. This required:

A) data on value added in the twelve sectors in the SAM, divided between private and public sector;

B) the division of value added in each sector and within each category, private and public, between wages and non-wage component;

C) Addition of the wage component of the public sector value added to private value added to arrive at the household income for each sector.

The data for 1976 value added were obtained from the Ministry of Planning, Department of National Accounts. The data was originally for eight different sectors. But with the help of data from the Census of Industrial Production and from estimation of agricultural income from the Ministry of Agriculture, the data were disaggregated into the twelve sectors of the input-output matrix.

Value Added Public & Private by Economic Sectors: 1976 (M.L.E.)

Sector	Public	Private	Total
1. Staple Food	28	289.0	317.0
2. Non-Staple Food	74	731.9	805.9
3. Cotton	-	202.0	202.0
4. Other Agriculture	-	438.0	438.0
5. Food Processing	30.4	133.6	164.0
6. Textiles	169.3	160.7	330.0
7. Other Industries	459.5	109.5	569.0
8. Construction	178.3	75.7	254.0
9. Crude Oil & Products	266.1	57.9	324.0
10. Transport & Communication	425.8	28.2	454.0
11. Housing	10.1	123.9	134.0
12. Other Services	956.0	1093.0	2049.0

The second step was to divide the value added in each sector into the wage and non-wage components. This data on wage by sector was available from the Ministry of Planning. By adding wages generated into the government and public sector to the private value added in each sector we arrived at the domestically earned household income in each sector as follows:

Household Income by Sector: 1976

Sector	Household Income
1. Staple Food	302
2. Non-Staple Food	755
3. Cotton	202
4. Other Agriculture	438
5. Food Processing	150
6. Textiles	277
7. Other Industries	274
8. Construction	170
9. Crude Oil & Products	75
10. Transport & Communication	193
11. Housing	125
12. Services	1962
Total	4923

To domestically earned household income the 310 M.L.E. of remittances were added treating these as household exports or factor income earned abroad. Thus, the total income of the household sector becomes 5233 M.L.E. This is shown in row 21 column 41 in the SAM.

3. Factor shares in value added

The next step is to explain the estimation of the shares in each economic sector and then the share of each income class in each factor

share. For the first four production sectors three factor shares, labor, land, and capital, had to be estimated. Information was obtained on the area cultivated for each crop, the output of that crop in 1976 and prices per unit of output in 1976. This data was secured from the Ministry of Agriculture, Department of Economics and Statistics. With this data it was possible to estimate the value of gross production for each crop. The Ministry of Agriculture also publishes every year estimates of the cost of production per feddan (unit of land) for each crop. From this data the value of intermediate inputs used per unit of land per crop was estimated. Then the value of intermediate inputs for the entire crop was calculated by multiplying the area under each crop by the value of intermediate inputs per unit of land for that crop. Subtracting the value of intermediate inputs from gross production led to the value added generated by each crop for all the crops cultivated in 1976.

The data on the cost of production include data on labor cost per crop. This was estimated by the Ministry of Agriculture as the number of labor inputs per feddan per crop multiplied by the average wage. However, the estimated labor cost based on wage rates appeared from general knowledge to be below the average wage prevailing in the labor market in agriculture. There seemed also in these rent data an underestimate. Rent per crop in the free market, for those who own land and do not rent it by the official contracts but can rent it per crop to the highest bidder, sometimes reaches five times the official rent. Thus the figures for both rent and wages were both adjusted upwards to account for these observations. By multiplying the rent per feddan per crop with the area cultivated by that crop we arrived at the share of rent in value added. The share of wages in value added per

crop was calculated similarly. The share of capital represented the residual. By adding up the share of rent and wages for all the crops included in each of the four sectors we arrived at the labor, capital, and land shares for each of the four agricultural sectors.

In the remaining eight productive sectors only two factor shares were estimated. The information for factor shares in both public and private sector activity was obtained from both the Ministry of Planning and the Census of Industrial Production.

The factor shares in all the sectors were estimated as follows:

Factor Shares in the Egyptian Economy 1976.

Sector	Private Sector			Public Sector	
	Labour	Capital	Rent	Labour	Capital
1- Staple Food	0.443	0.306	0.251	0.464	0.536
2- Non-Staple Food	0.372	0.402	0.226	0.312	0.688
3- Cotton	0.456	0.312	0.232	-	-
4- Other Agriculture	0.451	0.182	0.367	-	-
5- Food Processing	0.299	0.701	0.0	0.539	0.461
6- Textile Industry	0.314	0.686	0.0	0.687	0.313
7- Other Industries	0.383	0.617	0.0	0.358	0.642
8- Construction	0.496	0.504	0.0	0.529	0.471
9- Crude Oil & Products	0.070	0.930	0.0	0.604	0.936
10 - Transportation & Communication	0.388	0.612	0.0	0.387	0.613
11- Housing	0.400	0.600	0.0	0.110	0.880
12- Other Services	0.400	0.600	0.0	0.909	0.091

4. The share of income classes in factor shares

The objective of this step is to estimate the share of each income class in each of the factor shares in each sector (1....,12). In the first four sectors in which rents are earned it was necessary to relate the pattern of land distribution by ownership to the three classes: lowest 60%, middle 30%, top 10%. The class of landless agricultural laborers who own no land was included in the first class, i.e., the lowest 60% of income recipients. But this required an estimate of agricultural landless labor and hence landless population. The estimate of the landless population began with the rural population or rural families in 1976. It was assumed that agricultural population represents 80% of rural population, hence agricultural rural families represent 80% of the number of families. From agricultural census of 1965 an estimate was made of the number of land owning families. The difference between land owning families and total agricultural families represent landless families with the average size of the family a value for the agricultural landless population was calculated. The results were compared with information from the 1974, May round of the Labor Force Sample Survey concerning wage labor in agriculture. The estimate used, based on these two sources, of landless population comes to 35% of labor force and population.

The distribution of land-ownership was obtained from agricultural censuses of 1961 and 1965. A curve was fitted to the pattern of distribution from which the share of lowest 60%, middle 30%, and top 10% was estimated. Bearing in mind that the lowest income class includes the landless labor as well, the pattern of distribution of land was calculated as follows:

Distribution of Land Ownership

Percent of Population	Percent of Land
0 - 60	7.0%
60 - 90	28.5%
90 - 100	64.5%

The distribution of the share of rent among the three income classes was estimated according to the above distribution of land.

The distribution of wage share among the three income classes was based on the distribution of the permanent labor force according to the size of the farm in 1961 agricultural census. The temporary (casual) labor force was also added to the first income class.

The distribution of profits, the residual, was made with regard to two factors: 1) the distribution of land ownership and holdings; 2) the pattern of crops cultivated in different farms of different size. The second factor is very important due to the great range of differences among the profitability rates of different crops, say, between wheat and vegetables or citrus production, or between cotton and rice. The shares of the three classes in the three factor shares become as follows:

		SSPL	SSPK	SSPR
0 - 60%		0.763	0.285	0.070
60 - 90%	Sector I	0.175	0.413	0.330
90 -100%		0.062	0.302	0.600
0 - 60%		0.753	0.217	0.050
60 - 90%	Sector II	0.175	0.413	0.350
90 -100%		0.072	0.352	0.600
0 - 60%		0.821	0.181	0.070
60 - 90%	Sector III	0.154	0.417	0.385
90 -100%		0.025	0.402	0.545
0 - 60%		0.771	0.210	0.070
60 - 90%	Sector IV	0.182	0.382	0.385
90 -100%		0.047	0.408	0.545

For the rest of the sectors, as was mentioned before, only two factors shares, labor and capital, were calculated for both private and public sectors. For the share of wages among different income classes, complete reliance was placed on the CAPMAS annual report on "Emoloyment, Wages, and Hours of Work." This source provides information for other 20 sectors (public and private) on the distribution of labor (employment) according to different levels (ranges) of wage rates per week. This includes laborers and white collar employees. From this the wage bill in each sector according to employment in different categories of wage rates was calculated. Then a curve was fitted for each sector, private and public, relating the percentage distribution of employment and the percentage distribution of the wage bill in that sector. From this curve it was possible to estimate

the share of each class of income recipient in the total wage bill in every sector whether private or public. For the distribution of the shares of different income classes in the wage bill of the government service sector, data was obtained from the 1976 state budget on the distribution of conventional government employees according to categories of of wages and salaries and the total wage bill in every category. From this information it was possible to calculate the share of lowest 60%, middle 30%, and top 10% of income recipients in the government wage bill.

As for the distribution of the share of profit, in different sectors, among the three income classes, the distribution of industrial establishments in every industrial activity according to its contribution to total value added in that industrial activity was used. This information was provided by the industrial census of establishment 1968.

The distribution of the factor shares in the remaining eight sectors was as follows:

The Share of Income Classes
In Factor Shares

Sector	Private		Public
	SSPL	SSPK	SSGL
5- Food Processing	0.494	0.150	0.414
	0.193	0.350	0.286
	0.313	0.500	0.300
6- Textile Industry	0.598	0.150	0.414
	0.265	0.350	0.326
	0.137	0.500	0.260
7- Other Industries	0.451	0.150	0.351
	0.239	0.350	0.337
	0.310	0.500	0.312
8- Construction	0.394	0.150	0.167
	0.381	0.350	0.083
	0.225	0.500	0.750
9- Crude Oil & Products	0.044	0.00	0.044
	0.581	0.300	0.581
	0.375	0.700	0.375
10- Transport & Construction	0.226	0.150	0.286
	0.137	0.350	0.326
	0.637	0.500	0.387
11- Housing	0.379	0.200	0.385
	0.352	0.300	0.341
	0.269	0.500	0.274
12- Services	0.379	0.200	0.385
	0.352	0.300	0.341
	0.269	0.500	0.274

In the government and public sectors the share of middle 30% is larger than the share of this class in the private sector in general. Moreover, in sectors where public activity dominates, the share of the first two classes is higher compared to private sector.

The share of wages in the government agricultural sector was distributed according to the distribution of labor.

5. The distribution of emigrant remittances

There remains only one element to distribute among income classes: workers remittances from abroad. First workers remittances was added to the wage side. Secondly it was distributed according to the occupational distribution of emigrants,(1) and their average wage before leaving.

Shares of Remittances Among Income Classes: Rural-Urban

	Urban	Rural
0 - 60	0.210	0.082
60 - 90	0.290	0.066
90 -100	0.300	0.052
	1.0	1.0

Both rural and urban shares add to one.

From the above information of shares of factors and the share of each income class in every factor share, the distribution of gross household income in every sector (1...., 12) among the six income classes, 3 rural and three urban, has been calculated. From this the share of each income class in total income was estimated. The results of the estimation are contained the SAM, rows 15 to 20, and the share of each income class in

1) Source: Population Movements Across the Borders, CAPMAS, 1973

gross household income appears in SAM in column 41 corresponding to rows (15 to 20). The distribution of income is as follows:

Distribution of Income: 1976

Income Class	Rural	%	Urban	%
0 - 60	721	41	1042	30
60 - 90	535	30.4	1126	32.4
90 - 100	503	28.6	1305	37.6
	1759	100	3473	100
Share in Total:	33.6%		66.4%	

It should be noted again, however, that rural in the context of distribution of income in this work means agricultural and not proper rural. That is why rural here includes only agricultural value added. Thus non-agricultural activities in rural areas like industry in services are treated as urban.

6. The distribution of expenditure

The last task in this undertaken was the estimate of the distribution of consumption expenditures by income class. All items included in column 21 of the SAM, total household expenditures, had to be distributed among the six income classes. This part will take up first the distribution of final consumption demand for the output of the twelve sectors i.e., the first twelve items in column 21 of the SAM. Added to this is the distribution of the item in row 26, column 21, direct imports by the household sector which are mainly consumer goods like refrigerators, automobiles and other

consumer goods. In addition, the 60 M.L.E. which represents tariffs on these imports must be distributed. This represents the item in row 28, column 21.

The family budget survey of 1974/75 carried out by the CAPMAS was the starting place for these estimates. The total size of the sample is 12000 households. The data were collected from these family groups every three months in consequent order to cover the whole year in four rounds. The data that was used represents the first and second rounds.

The urban rounds include sixteen size classes of total expenditure divided according to the average expenditure per family per year. It also contains information about the number of households interviewed in every expenditure class and the size of population in that expenditure class. The rural rounds include also sixteen expenditure classes.

From the data available in the survey it was possible to divide the expenditure classes into six socio-economic groups corresponding to the six socio-economic groups for which the distribution was calculated.

The lowest 60% of the urban population includes the first 11 expenditure groups from less than L.E. 50 expenditure per year to less than L.E. 600. The middle 30% in urban areas include the next three expenditure classes from 600 to less than L.E. 1000 expenditure per year. The top 10% of urban classes include the next two classes from 1000 to more than L.E. 2000 expenditure per year.

In the rural areas the lowest 60% of income recipients include the first nine expenditure groups, from zero to less than L.E. 350 expenditure per year. The middle 30% included the next three groups, from 400 to less than L.E. 800 expenditure per year. The top 10% of rural areas include

the next four groups, from 800 to over L.E. 2000 expenditure per year.

The family budget survey of 1974/75 contains information, for the 16 households expenditure classes in both urban and rural areas, about expenditure on 38 items. These are in order as follows:

1- Cereals and starches
2- Pulses
3- Fresh and canned vegetables
4- Fresh and canned fruits
5- Meat and poultry
6- Fish and fish products
7- Eggs
8- Milk and dairy products
9- Fats and oil
10- Sugar and sugar products
11- Other food products
12- Tea and coffee
13- Other beverages
14- Total expenditure on food and beverage
15- Total expenditure on cloth and wear
16- Textile and final wear
17- Foot-wear (shoes)
18- Expenditure on accomodation and its needs (total)
19- Expenditure on accomodation
20- Power and electricity and energy
21- Total expenditure on furniture households tools and equipments on household services
22- Furniture and fixtures
23- Household cleaning materials
24- Payments for household services
25- Medical care expenditure
26- Total expenditure on transport
27- Private means of transport
28- Costs of transport and communication
29- Education
30- Total Expenditure on culture and recreation
31- Special tools and equipments for culture and recreation
32- Expenditure on culture and recreation
33- Total of other types of expenditure
34- Private tools
35- Tools and materials for cleaning and cosmetics
36- Tobacco products
37- Services and other expenditures
38- Total consumption expenditure
39- Transfer payments
40- Installments paid in advance
41- Total expenditure per year

The last three items were excluded from the sub-totals of expenditures. The rest of the items were aggregated and distributed according to 13 sectors in the SAM. These 13 sectors include the major 12 sectors in the input-output table in the SAM, plus the household imports sector which is referred to in the SAM as row 26, column 21. This represents the 125 M.L.E. household import and 60 M.L.E. tariffs. The rule followed in allocating the items in the family budget among the thirteen sectors was as follows:

Distribution of Expenditure Items
Among the Sectors in the
S.A.M.

Sector 1.	$0.5\,A_1 + 0.5\,A_2$
Sector 2.	$0.5\,A_3 + 0.5\,A_1 + 0.5\,A_5 + A_6 + A_7$
Sector 3.	0
Sector 4.	$0.2\,A_{22} + 0.2\,A_{23}$
Sector 5.	$0.5\,A_1 + 0.5\,A_2 + 0.5\,A_3 + 0.5\,A_4 + 0.5\,A_8 + A_9 + A_{10} + A_{11} + A_{12} + A_{13} + 0.5\,A_{36}$
Sector 6.	$0.5\,A_{16} + 0.5\,A_{17}$
Sector 7.	$0.5\,A_{20} + 0.8\,A_{22} + 0.8\,A_{23} + A_{35}$
Sector 8.	0
Sector 9.	$0.5\,A_{20}$
Sector 10.	A_{28}
Sector 11.	$A_{24} + 0.5\,A_{37}$
Sector 12.	$0.5\,A_{16} + A_{19} + A_{25} + A_{29} + A_{32} + A_{34} + 0.5\,A_{37}$
Sector 13.	$0.5\,A_8 + A_{27} + A_{31} + 0.5\,A_{35} + 0.5\,A_{36}$
Sector 14.	A_{38}
Sector 15.	A_{42}

The A_i represents the row of every expenditure item. Thus A_1 represents the expenditure on cereals and starches, A_3 represents expenditure on fresh and canned vegetables. Also 0.5 A_1 means half expenditure on cereals and starches.

This procedure of distributing expenditures was carried out for each of the six income classes, 3 rural and 3 urban, to obtain the consumption expenditures according to the sectors in the SAM.

The expenditure of each income class on the products of each of the 13 sectors was divided by total consumption expenditure of that class in 1974/75 family budget survey. This generated the ratios or shares of consumption expenditure on the products of each sector by each income class in relation to the total expenditure of that income class.

The next step was the multiplication of the per-capita expenditures of each income class as calculated from 1974/75 family budget survey by the total population of that class as calculated from 1976 population census. This was done to arrive at total expenditure by each income class in 1976. However, the figures arrived at did not add up to total consumption expenditure in 1976, but rather were underestimates. To adjust this, the data were scaled to fit the total expenditure of 1976 as shown in the SAM, column 21. The scaling factor was $(\frac{4111}{3535})$.

The figures arrived at concerning total expenditure by each income class were multiplied by the shares (ratio) of expenditure of that class on the 13 sectors. This led to the expenditure of each income class on the products of the 12 sectors plus imports. These are shown in the SAM in columns 15 to 20 corresponding to rows from 1 to 12, and in columns 15

to 20 corresponding to row 26. The distribution of other items of expenditure in the SAM, like indirect taxes, direct taxes and transfers will be discussed when the calculation of the rows that include these items of expenditure is explained.

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9. Savings and Investment

The savings-investment balance results from independent decisions and influences on each component as well as overall balancing forces. One of the components of the balance is transfers to government from the household sector. This is the net surplus of social security and pensions funds, equal to 296 million L.E. Since it is a part of public savings, it is located in row 22 which is the surplus in the government and the public sector. It can be considered as a kind of forced savings, but of a different nature from taxation. The source of data on these transfers is the Follow-up Report of 1976 from the Ministry of Planning. The surplus of social security and pensions funds is located in SAM in column 21 of the household sector and row 31 of government transfers. Since it is paid by the household sector, it has to be distributed among the six income groups in columns 15-20. However social security and pensions contribution systems do not exist in agriculture; they are paid only by urban labour force. Thus the amount of payments was distributed among the three urban classes. This was done according to the share of wage income of each income class in the total urban wage income.

Private savings are located in row 34, column 21. They are a residual item in SAM for each income class being the difference between the income of the class and the total expenditure of that class. Total private savings in 1976 were 394 million L.E according to the 1976 Follow-up Report, Ministry of Planning. Row 34, columns 15 to 20 in the SAM show that the first two classes in urban areas, the lowest 60 percent amd middle 30 percent, have negative savings.

Row 35 deals with government and public sector savings. These are identified in row 35 under column 22 of G_1 and are equal to 1414 million L.E. To investigate government and public sector savings, it is necessary to return to row 22 in SAM. This represents the surplus generated in the public sector production units calssified in twelve producing sectors. The data for row 22 were obtained from National Income Accounts Department and Industry Department at the Ministry of Planning. The data on wages in the public sector, classified in 12 producing sectors, were subtracted from the value added for these sectors. The residual represents the surplus generated by sector. Part of this surplus is transferred and part retained by the production units. The data on surpluses in public sector, by production sector are as follows:

SURPLUS IN THE PUBLIC SECTOR

1976 million L.E.

	Sector	Surplus
1-	Staple Food	15
2-	Non-staple Food	51
3-	Cotton	--
4-	Other Agriculture	--
5-	Food Processing	14
6-	Textiles	53
7-	Other Industries	295
8-	Construction	84
9-	Crude Oil and Products	249
10-	Transport & Communication	261
11-	Housing	9
12-	Other Sources	87
	Total	1,118

Besides the public sector surplus, there is in row 22, column 31 the net surplus of the social security and pensions funds 296 million L.E. This makes the total government and public sector surplus (savings) equal to 1414 million L.E.

Foreign savings appear in row 38, column 27. This represents the balancing item between exports and imports. In 1976, foreign savings were equal to 654 million L.E. Total savings will then be equal to:

Total Savings = Private Savings + Public & Government Surplus - Conventional Government Deficit - Government Trade Sector Deficit + Foreign Savings.

Total Savings = 394 + 1414 - 393 - 389 + 654 = 1680 million L.E. .

The government conventional deficit and the government trade deficit represent the balancing items in the government conventional and trade accounts. They are located in SAM in rows 35 and 36, columns 23 and 24.

Total investment in 1976 was 1,680 million L.E. at 1976 prices. This is divided into 1567 million L.E. fixed investment and 113 million L.E. changes in stocks. Columns 34 to 38 deal with investment. This is divided into public sector investment, column 35, private investment, column 34, government conventional investment, column 36 and government trade investment, column 38. Unfortunately, this breakdown of data on investment is not available. The only figure available includes both public and private investment. Thus the figures on investment which appear in column 36 in SAM is, in actual fact, the summation of columns 34 to 38.

The final investment goods supplied from domestic production appears in SAM in column 36. For 1976, this was equal to 1085 million L.E., distributed

by delivery sectors as follows:

		Investment Final Demand 1976 (M. L.E.)
1-	Staple Food	-
2-	Non-staple Food	1
3-	Cotton	-
4-	Other Agriculture	-
5-	Food Processing	-
6-	Textiles	3
7-	Other Industries	360
8-	Construction	599
9-	Crude Oil and Products	-
10-	Transport & Communication	-
11-	Housing	-
12-	Other Services	122
	Total	1085

The imports of capital goods are found down the column 36, row 26, other imports. This is equal to 391 million L.E. These are capital goods imports at CIF prices; tariffs should be added to obtain an internal valuation. This is found in column 36, row 38 and equals 91 million L.E. Total capital goods imports are then 482 million L.E. This makes gross investment equal to 1567 million L.E. The source for capital goods imports is the Follow-up Report of 1976, Ministry of Planning.

Changes in stocks, ΔS, appear in SAM in column 39 as part of the final demand vector for 1976. Changes in stocks in 1976 equal to 113 million L.E. They appear in column 39 by delivery sectors as follows:

Changes in Stocks
1976 (M. L.E.)

1-	Staple Food	16
2-	Non-staple Food	-
3-	Cotton	-
4-	Other Agriculture	-
5-	Food Processing	10
6-	Textiles	46
7-	Other Industries	40
8-	Construction	-
9-	Crude Oil & Products	1
10-	Transport & Communication	-
11-	Housing	-
12-	Other Services	-
	Total	113

The source of changes in stocks is the National Income Accounts Department of the Ministry of Planning.

total investment and changes in stocks appear in SAM in column 40. It represents the summation of columns 34-39. Thus total investment is equal to 1198 million L.E., domestic production, + 482 imports of capital goods = 1680 million L.E.

10. Computer Program for the GEM-1 and GEM-2 Models

```
0001                  COMMON Z(40,40),A(40,40),B(40),BI(40),BE(40),VAA(40),ZT(40),X(13)
                     2,THE(13,6),DSHAT(6),TEXR(6),QH(13,6),ALP(13,6),Z21(12),Z22(12),
                     3C(6,12),CI(6),S1(12),S2(6),GM(12),HM(12),YC(6),
                     4SBL(13),   SPL(13),SPK(13),SPR(13),SSPR(6,13),SSBL(6,13),SBK(13),
                     5SSPL(6,13),SSPK(6,13),QI(13),SECN(13,13),GNAME(4,13)
                     6,YO(14),SECT(10,13),SECC(14,13)
0002                  COMMON      YH(6),YD(6),YEP(6),YE(6), AM34(6),AM29(6),AM25(6),
                     2AM24(6),AW(12,12),F1(12),F2(12),QG1(12),QG2(12),QG3(12),XPD(12),
                     3XE(12),XINV(12),XDST(12),
                     4 CLP(12),CLK(12),CLT(12),CLG(12),CLB(12),WAGE(12),RENT(12),KAP(12)
                     5,KAPG(12),WAGG(12),CY(14),GE(4),GO(4),TNET(4),Y(14),      SHAT(6)
                     6,CH(12),CG(12),HP(12),HG(12), D(13),HMR(12),GMR(12)
0003                  CALL  REED
0004                  DO  3001  I=1,12
0005                  HMR(I)=HM(I)
0006                  GMR(I)=GM(I)
0007             3001 CONTINUE
0008                  DO  131   I=15,20
0009                  Z(I,26)=CI(I-14)
0010                  DO  131  J=1,12
0011                  Z(I,J)=C(I-14,J)
0012             131  CONTINUE
0013                  DO  122  I=1,12
0014                  WAGE(I)=1.
0015                  KAP(I)=1.
0016                  RENT(I)=1.
0017                  WAGG(I)=1.
0018                  KAPG(I)=1.
0019             122  CONTINUE
0020                  M=12
0021                  N=12
0022                  L=13
0023                  ICNT=0
0024              57  ICNT=ICNT+1
0025                  NNN=0
0026                  DO 152 I=1,40
0027                  B(I)=1.0
0028                  BE(I)=1.0
0029                  BI(I)=1.0
0030                  VAA(I)=1.0
0031              152 CONTINUE
0032                  BB=1.0
0033                  BE(1)=2.0
0034                  BE(2)=3.0
0035                  BE(3)=1.55
0036                  BE(9)=3.041
0037                  DO  111  I=1,12
0038                  X(I)=ZT(I)
0039                  HM(I)=HMR(I)
0040                  GM(I)=GMR(I)
0041                  CH(I)=HM(I)/X(I)
0042                  CG(I)=GM(I)/X(I)
0043             111  CONTINUE
```

```
0044                  IF(ICNT.GT.5)GO  TO  289
0045                  WRITE(6 ,666)ICNT
0046             666  FORMAT(////,20X,'POLICY ',I2,///)
0047                  GO  TO    (155,156,157,158,159),ICNT
0048             155  Z(30,5)=-182.
0049                  A(30,5)=-182./1522.
0050                  GO TO 10
0051             156  Z(30,5)=0.
0052                  A(30,5)=0.
0053                  GO TO 10
0054             157  Z(30,5)=-32.
0055                  A(30,5)=-32./1522.
0056                  GO TO 10
0057             158  Z(30,5)=-182.
0058                  A(30,5)=-182./1522.
0059                  Z(8,36)=1099.
0060                  A(8,36)=1099./2067.
0061                  GO TO 10
0062             159  Z(8,36)=599.
0063                  A(8,36)=599./1567.
0064                  Z(32,16)=37.07
0065                  A(32,16)=37.07/1126.
0066                  Z(32,17)=84.84
0067                  A(32,17)=84.84/1305.
0068                  Z(32,19)=16.61
0069                  A(32,19)=16.61/535.
0070                  Z(32,20)=30.72
0071                  A(32,20)=30.72/503.
0072                  DO 444 J=1,40
0073             444  BI(4)=1.5
0074              10  CONTINUE
0075                  DO 103 I=1,12
0076                  QG1(I)=Z(I,22)
0077                  QG2(I)=Z(I,23)
0078                  QG3(I)=Z(I,24)
0079                  XPD(I)=Z(I,25)
0080                  XE(I)=Z(I,26)
0081                  XINV(I)=Z(I,36)
0082                  XDST(I)=Z(I,39)
0083             103  CONTINUE
0084                  NNN=NNN+1
0085                  DO  172  I=1,12
0086                  IF(WAGF(I).EQ.0.)WAGE(I)=1.
0087                  IF(RENT(I).EQ.0.)RENT(I)=1.
0088                  IF(KAP(I).EQ.0.)KAP(I)=1.
0089                  IF(KAPG(I).EQ.0.)KAPG(I)=1.
0090                  IF(WAGG(I).EQ.0.)WAGG(I)=1.
0091                  HP(I)=CH(I)*WAGE(I)**SPL(I)*KAP(I)**SPK(I)*RENT(I)**SPR(I)
0092                  HM(I)=HP(I)*X(I)
0093                  HG(I)=CG(I)*WAGG(I)**SBL(I)*KAPG(I)**SBK(I)
0094                  GM(I)=HG(I)*X(I)
0095             172  CONTINUE
0096                  DO 200 I=1,M
```

```
0097                F1(I)=HP(I)+HG(I)
                   1+(A(25,I)+A(26,I)+A(28,I))*BI(I)
0098              200 CONTINUE
0099                  DO  210  I=1,M
0100                  TERM=A(24,I)+A(29,I)+A(30,I)+A(32,I)
0101                  DO 210 J=1,N
0102                  IF(I.EQ.J)GO TO 205
0103                  AW(I,J)=-A(J,I)
0104                  GO TO 210
0105              205 AW(I,J)=1-TERM-A(J,I)
0106              210 CONTINUE
0107                  CALL MATINV(AW,M)
0108                  CALL AMULB(AW,F1,B,M,N,1)
                C     THIS PART CALCULATE INCOME GENERATION
0109                  DO  16  I=1,6
0110                  K=I+14
0111                  YH(I)=0.
0112                  DO  15  J=1,12
0113                  T1=SSPL(I,J)*HM(J)*SPL(J)
0114                  T2=SSPF(I,J)*HM(J)*SPF(J)
0115                  T3=SSPR(I,J)*HM(J)*SPR(J)
0116                  T4=SSBL(I,J)*GM(J)*SBL(J)
0117                  YH(I)=YH(I)+T1+T2+T3+T4
0118               15 CONTINUE
0119                  YH(I)=YH(I)+CI(I)
0120                  YD(I)=(1-A(32,K)-A(31,K)-A(30,K))*YH(I)
0121                  AM34(I)=A(34,K)*YH(I)/YD(I)
0122                  YET(I)=(1-AM34(I))*YD(I)
0123                     YINR=YH(I)/YET(I)
0124                  AM29(I)=A(29,K)*YINR
0125                  AM25(I)=A(25,K)*YINR
0126                  AM24(I)=A(24,K)*YINR
0127                  YE(I)=(1-AM29(I)-AM25(I)-AM24(I))*YET(I)
0128               16 CONTINUE
0129                  DO  70  I=1,6
0130                  SHAT(I)=0.
0131                  DO  72  J=1,13
0132                  SHAT(I)=SHAT(I)+THE(J,I)*B(J)
0133               72 CONTINUE
0134                  DO  73  J=1,13
0135                  QH(J,I)=THE(J,I)+(YE(I)-SHAT(I))*ALP(J,I)/B(J)
0136               73 CONTINUE
0137               70 CONTINUE
0138                  DO  250  I=1,M
0139                  SQ=0.
0140                  DO  999  J=1,6
0141              999 SQ=SQ+QH(I,J)
0142                  F2(I)=SQ+QG1(I)+QG2(I)+QG3(I)+XPD(I)+XE(I)+XINV(I)+XDST(I)
0143               250 CONTINUE
0144                  DO 260 I=1,M
0145                  DO 260 J=1,N
0146                  IF(I.EQ.J)GO TO 255
0147                  AW(I,J)=-A(I,J)
```

```
0148                  GO TO 260
0149              255 AW(I,J)=1-A(I,J)
0150              260 CONTINUE
0151                  CALL MATINV(AW,M)
0152                  CALL AMULB(AW,F2,X,M,N,1)
0153                  X(13)=0
0154                  DO  77  I=1,12
0155                  X(13)=X(13)+X(I)
0156               77 CONTINUE
0157                  DO  44  I=1,13
0158               44 D(I)=100*(X(I)-QI(I))/QI(I)
                  C     THIS PART CALCULATE GOVERNMENT
                  C          WHERE : G1=GOVERNMENT AND PUBLIC SECTOR
                  C                  G2=CONVENTIONAL
                  C                  G3=TRADE
                  C          USING : "E" FOR EXPENDITURE
                  C                  "R" FOR REVINUE
0159                  GMSB=0.
0160                  A30BX=0.
0161                  A28BI=0.
0162                  A29BX=0.
0163                  A32BX=0.
0164                  Z24B=0.
0165                  A25BI=0.
0166                  A26BI=0.
0167                  G1E=0.
0168                  Z23P=0.
0169                  Z36B=0.
0170                  DST=0.
0171                  DO  20  I=1,12
0172                  GMSB=GMSB+GM(I)*SBK(I)
0173                  Z23B=Z23B+Z(I,23)*B(I)
0174                  Z36B=Z36B+Z(I,36)*B(I)
0175                  DST=DST+Z(I,39)*B(I)
0176                  G1E=G1E+Z(I,22)*B(I)
0177                  A30BX=A30BX+A(30,I)*B(I)*X(I)
0178                  A28BI=A28BI+A(28,I)*BI(I)*X(I)
0179                  A29BX=A29BX+A(29,I)*B(I)*X(I)
0180                  A32BX=A32BX+A(32,I)*B(I)*X(I)
0181                  Z24B=Z24B+Z(I,24)*B(I)
0182                  A25BI=A25BI+A(25,I)*BI(I)*X(I)
0183                  A26BI=A26BI+A(26,I)*BI(I)*X(I)
0184               20 CONTINUE
0185                  A31Y=0.
0186                  A30Y=0.
0187                  Q13B=0.
0188                  AY29=0.
0189                  A32Y=0.
0190                  AY25=0.
0191                  AY24=0.
0192                  SP=0.
0193                  DO  30  J=1,6
0194                  K=J+14
```

```
0195                  A31Y=A31Y+A(31,K)*YH(J)
0196                  A30Y=A30Y+A(30,K)*YH(J)
0197                  Q13B=Q13B+QH(13,J)*BI(21)
0198                  AY29=AY29+AM29(J)*YET(J)
0199                  A32Y=A32Y+A(32,K)*YH(J)
0200                  AY25=AY25+AM25(J)*YET(J)
0201                  AY24=AY24+AM24(J)*YET(J)
0202                  SP=SP+AM34(J)*YD(J)
0203               30 CONTINUE
                   C     THIS PART CALCULATE PRICE DIFFERENCE
0204                  PD=17*(BP(1)-B(1))+2*(BE(2)-B(2))+100*(BE(3)-B(3))
                     1+49*(BE(9)-B(9))
0205                  G1R=GMSB+A31Y
0206                  SSUB=A30BX+A30Y
0207                  TIND=A29BX+AY29
0208                  G2E=Z233-0.284*SSUB
0209                  G2R=A23BI+0.324*Q13B+0.2327*Z(26,40)+TIND*0.957+A32BX+A32Y
0210                  GEX=17.*B(1)+2.*B(2)+100.*B(3)
0211                  G3E=Z24B+A25BI+AY25-0.716*SSUB+AY24
0212                  G3R=      AY25+A(24,5)*BI(5)*X(5)+GEX+0.043*TIND+AY24+A25BI
0213                  DO  777  I=1,12
0214                  CLP(I)=SPL(I)*HM(I)/WAGE(I)
0215                  CLK(I)=SPK(I)*HM(I)/KAP(I)
0216                  CLT(I)=SPR(I)*HM(I)/RENT(I)
0217                  CLG(I)=SBL(I)*GM(I)/WAGG(I)
0218                  CLB(I)=SBK(I)*GM(I)/KAPG(I)
0219               777 CONTINUE
0220                  ZBET=0
0221                  DO 40 I=1,M
0222                  ZBET=ZBET+Z(I,26)*B(I)
0223               40 CONTINUE
0224                  PEXP=ZBET+Z(21,26)*BE(21)+GEX+PD
0225                  PIMP=A25BI+AY25+A26BI+0.676*Q13B+Z(26,40)*BI(40)
                   C     THIS PART CALCULATE SVING-INVESTMENT
0226                  SG1=G1R-G1E
0227                  SG2=G2R-G2E
0228                  SG3=G3R-G3E
0229                  SF=PIMP-PEXP
0230                  SSS=SP+SG1+SG2+SG3+SF
0231                  PINV=    Z(26,36)*BI(36)*1.2327 +Z36B
0232                  PINVT=PINV+DST
0233                  BAL=(SSS-PINVT)/PINVT
0234                  Y(5)=PEXP
0235                  Y(6)=PIMP
0236                  Y(7)=SF
0237                  Y(8)=PINV
0238                  Y(9)=DST
0239                  Y(10)=PINVT
0240                  Y(11)=SP
0241                  Y(12)=PD
0242                  Y(13)=SG1+SG2+SG3
0243                  Y(14)=Y(13)+Y(11)
0244                  GE(1)=G1E
```

```
0245                    GE(2)=G2E
0246                    GE(3)=G3F
0247                    GE(4)=GE(1)+GE(2)+GE(3)
0248                     GO(1)=G1R
0249                    GO(2)=G2R
0250                    GO(3)=G3R
0251                    GO(4)=GO(1)+GO(2)+GO(3)
0252                    TNET(1)=SG1
0253                    TNET(2)=SG2
0254                    TNET(3)=SG3
0255                    TNET(4)=SG1+SG2+SG3
0256                    DO  88  I=5,14
0257                 88 CY(I)=(Y(I)-YO(I))*100/YO(I)
0258                    IF(NNN.GT.10) GO TO 3
0259                    IF(BAL.LT.-0.1E-02.OR.BAL.GT.0.1E-02) GO TO 10
0260                    GO  TO  3
0261                 3  WRITE(6,503)
0262                    WRITE(6 ,504) (B(I),I=1,M)
0263                 503 FORMAT(//,20X,'THE NEW PRICES ARE',//)
0264                 504 FORMAT(//,2(5X,7(F12.6,3X),/))
0265                    WRITE(6,199)
0266                    WRITE(6,299)
0267                    DO  29  I=1,13
0268                 29 WRITE(6,506) (SECN(I,J),J=1,13),X(I),QI(I),D(I)
0269                    WRITE(6,1100)
0270                    DO  87  I=1,6
0271                 87 WRITE(6,1002)I,YH(I),YD(I),YET(I),YE(I)
0272                1002 FORMAT(10X,I5,5X,4(F10.5,5X))
0273                    WRITE(6,1003) (SHAT(I),I=1,6)
0274                    DO  71  J=1,13
0275                71  WRITE(6,1004)J,(QH(J,I),I=1,6)
0276                1003 FORMAT(20X,'SHAT  EQUALS',/,10X,6(F10.5,5X),///,20X,'HOUSEHOLD
                        *  CONSUPTION  BY  CLASSES',//)
0277                1004 FORMAT(10X,I5,5X,6(F10.5,5X))
0278                1100 FORMAT(24X,'YH',13X,'YD',13X,'YET',12X,'YE' )
0279                    WRITE(6,599)
0280                    WRITE(6,299)
0281                    DO  98  I=5,14
0282                 98 WRITE(6,505) (SECT(I,J),J=1,9),Y(I),YO(I),CY(I)
0283                    WRITE(6,499)
0284                    WRITE(6,699)
0285                    DO  96  I=1,4
0286                 96 WRITE(6,507) (GNAME(I,J),J=1,10),GE(I),GO(I),TNET(I)
0287                    WRITE(6,888)
0288                    WRITE(6,1500) (CLP(I),I=1,12)
0289                    WRITE(6,1500) (CLK(I),I=1,12)
0290                    WRITE(6,1500) (CLT(I),I=1,12)
0291                    WRITE(6,1500) (CLG(I),I=1,12)
0292                    WRITE(6,1500) (CLB(I),I=1,12)
0293                    GO TO 57
0294                888 FORMAT(20X,'LA,OR  CAPITAL AND  LAND DEMAND')
0295                1500 FORMAT(5X,12(F9.4,1X))
0296                199 FORMAT(1H1,///,35X,'GROSS  OUTPUT',//)
```

```
0297              299  FORMAT(30X,'FINAL',6X,'INITIAL',7X,'CHANGE',//)
0298              499  FORMAT(35X ,'GOVT.  SECTOR',//)
0299              599  FORMAT(1H1,///,30X,'OTHER IMPORTANT VARIABLES',//)
0300              699  FORMAT(26X,'EXPENDITURE',5X,'REVENUE',10X,'NET',//)
0301              505  FORMAT(6X,9A2,3(F10.3,3X),/)
0302              506  FORMAT(2X,13A2,3(F10.3,3X),/)
0303               507 FORMAT(5X,10A2,3(F12.3,3X),/)
0304               289 STOP
0305                   END
```

```
0001                  SUBROUTINE  REED
0002                  COMMON Z(40,40),A(40,40),B(40),BI(40),BE(40),VAA(40),ZT(40),X(13)
                     2,THE(13,6),DSHAT(6),TEXR(6),QH(13,6),ALP(13,6),Z21(12),Z22(12),
                     3C(6,12),CI(6),S1(12),S2(6),GM(12),HM(12),YC(6),
                     4SBL(13),   SPL(13),SPK(13),SPR(13),SSPR(6,13),SSBL(6,13),SBK(13),
                     5SSPL(6,13),SSPK(6,13),QI(13),SECN(13,13),GNAME(4,13)
                     6,YO(14),SECT(10,13),SECC(14,13)
0003                  COMMON     YH(6),YD(6),YET(6),YE(6), AM34(6),AM29(6),AM25(6),
                     2AM24(6),AW(12,12),F1(12),F2(12),QG1(12),QG2(12),QG3(12),XPD(12),
                     3XE(12),XINV(12),XDST(12),
                     4 CLP(12),CLK(12),CLT(12),CLG(12),CLB(12),WAGE(12),RENT(12),KAP(12)
                     5,KAPG(12),WAGG(12),CY(14),GE(4),GO(4),TNET(4),Y(14),      SHAT(6)
                     6,CH(12),CG(12),HP(12),HG(12), D(13),HMR(12),GMR(12)
0004                  READ(5,104) (Z21(I),I=1,12)
0005                  WRITE(6,101) (Z21(I),I=1,12)
0006                  READ(5,104) (Z22(I),I=1,12)
0007                  WRITE(6,101) (Z22(I),I=1,12)
0008                  READ(5,103) (SPL(I),I=1,13)
0009                  WRITE(6,101) (SPL(I),I=1,13)
0010                  READ(5,103) (SPK(I),I=1,13)
0011                  WRITE(6,101) (SPK(I),I=1,13)
0012                  READ(5,103) (SPR(I),I=1,13)
0013                  WRITE(6,101) (SPR(I),I=1,13)
0014                  READ(5,103) (SBL(I),I=1,13)
0015                  WRITE(6,101) (SBL(I),I=1,13)
0016                  READ(5,103) (SBK(I),I=1,13)
0017                  WRITE(6,101) (SBK(I),I=1,13)
0018                  DE21=1
0019                  Z26=310
0020                  DO  10  I=1,6
0021                  READ(5,103) (SSPL(I,J),J=1,13)
0022                  WRITE(6,101) (SSPL(I,J),J=1,13)
0023               10 CONTINUE
0024                  DO  20  I=1,6
0025                  READ(5,103) (SSPK(I,J),J=1,13)
0026                  WRITE(6,101) (SSPK(I,J),J=1,13)
0027               20 CONTINUE
0028                  DO  30  I=1,6
0029                  READ(5,103) (SSPR(I,J),J=1,13)
0030                  WRITE(6,101) (SSPR(I,J),J=1,13)
0031               30 CONTINUE
0032                  DO  40  I=1,6
0033                  READ(5,103) (SSBL(I,J),J=1,13)
0034                  WRITE(6,101) (SSBL(I,J),J=1,13)
0035               40 CONTINUE
0036                  DO  50  I=1,12
0037                  GM(I)=Z22(I)/SBK(I)
0038                  HM(I)=Z21(I)+Z22(I)-GM(I)
0039              50  CONTINUE
0040                  WRITE(6,101) (GM(I),I=1,12)
0041                  WRITE(6,101) (HM(I),I=1,12)
0042                  DO  70  J=1,6
0043                  TOT=0
```

```
0044                    DO  60  I=1,12
0045                    TE1=SPL(I)*SSPL(J,I)
0046                    TE2=SPK(I)*SSPK(J,I)
0047                    TE3=SPR(I)*SSPR(J,I)
0048                    TE4=SBL(I)*SSBL(J,I)
0049                    TOT=TOT+HM(I)*(TE1+TE2+TE3)+GM(I)*TE4
0050                 60 CONTINUE
0051                    YC(J)=TOT+RE21*Z26*SSPL(J,13)
0052                 70 CONTINUE
0053                    WRITE(6,102) (YC(J),J=1,6)
0054                    DO  80  I=1,6
0055                    CI(I)=310.*SSPL(I,13)
0056                    DO  80  J=1,12
0057                    T1=SSPL(I,J)*HM(J)*SPL(J)
0058                    T2=SSPK(I,J)*HM(J)*SPK(J)
0059                    T3=SSPR(I,J)*HM(J)*SPR(J)
0060                    T4=SSPL(I,J)*GM(J)*SBL(J)
0061                    C(I,J)=T1+T2+T3+T4
0062                 80 CONTINUE
0063                    DO  90  I=1,6
0064                 90  S2(I)=0.
0065                    DO  95  J=1,12
0066                 95 S1(J)=0.
0067                    DO  100  I=1,6
0068                    S2(I)=S2(I)+CI(I)
0069                    DO  100  J=1,12
0070                    S2(I)=S2(I)+C(I,J)
0071                    S1(J)=S1(J)+C(I,J)
0072                100 CONTINUE
0073                    S3=0.
0074                    DO  108  I=1,6
0075                108 S3=S3+CI(I)
0076                    DO  110  I=1,6
0077                110 WRITE(6,105) (C(I,J),J=1,12),CI(I),S2(I)
0078                    WRITE(6,106) (S1(I),I=1,12),S3
0079                    DO  79    J=1,6
0080                 79 READ(5,303) (ALP(I,J),I=1,13)
0081                    READ(5,509) (QI(I),I=1,13)
0082                    READ(5,555) (YO(I),I=1,14)
0083                    DO   9    I=1,13
0084                 9  READ(5,4) (SPCN(I,J),J=1,13)
0085                    DO  33  I=1,14
0086                 33 READ(5,4) (SECT(I,J),J=1,13)
0087                    DO  17  I=1,14
0088                 17 READ(5,4) (SECC(I,J),J=1,13)
0089                    DO  97  I=1,4
0090                 97 READ(5,4) (GNAME(I,J),J=1,13)
0091                    DO 1 I=1,40
0092                  1 READ(5,555) (Z(I,J),J=1,40)
0093                    READ(5,555) (ZT(I),I=1,40)
0094                    WRITE(6 ,520)
0095                    DO 151 I=1,40
0096                151 WRITE(6 ,504) (Z(I,J),J=1,40)
```

```
0097                    WRITE(6 ,521)
0098                    WRITE(6 ,504) (ZT(I),I=1,40)
0099                    DO 150 I=1,40
0100                    IF(ZT(I).EQ.0.)ZT(I)=0.1
0101                150 CONTINUE
0102                    DO 63 I=1,40
0103                    DO 63 J=1,40
0104                    A(I,J)=Z(I,J)/ZT(J)
0105                 63 CONTINUE
0106                    WRITE(6 ,503)
0107                    DO 305 I=1,40
0108                305 WRITE(6 ,504) (A(I,J),J=1,40)
0109                    DO 111 I=1,12
0110                    X(I)=ZT(I)
0111                111 CONTINUE
0112                    M=12
0113                    N1=12
0114                    DO 260 I=1,M
0115                    DO 260 J=1,N1
0116                    IF(I.EQ.J)GO TO 255
0117                    AW(I,J)=-A(I,J)
0118                    GO TO 260
0119                255 AW(I,J)=1-A(I,J)
0120                260 CONTINUE
0121                    WRITE(6,335)
0122                    DO  26  I=1,12
0123                 26 WRITE(6,336) (SECN(I,K),K=1,13),(AW(I,J),J=1,6)
0124                    DO   52  I=1,12
0125                 52 WRITE(6,336) (SECN(I,K),K=1,13),(AW(I,J),J=7,12)
0126                    CALL MATINV(AW,M)
0127                    WRITE(6,337)
0128                    DO  42  I=1,12
0129                 42 WRITE(6,336) (SECN(I,K),K=1,13),(AW(I,J),J=1,6)
0130                    DO  43   I=1,12
0131                 43 WRITE(6,336) (SECN(I,K),K=1,13),(AW(I,J),J=7,12)
0132                335 FORMAT(20X,'(1-A(I,J)) MATRIX',///)
0133                336 FORMAT(2X,13A2,6(F8.6,3X)//)
0134                337 FORMAT(20X,'INVERSE  MATRIX',///)
0135                    DO  21  J=1,6
0136                    K=J+14
0137                    TEXR(J)=Z(13,K)+Z(26,K)
0138                    DSHAT(J)=TEXR(J)*0.5
0139                 21 CONTINUE
0140                    DO  22  J=1,6
0141                    K=J+14
0142                    DO  23  I=1,12
0143                    QH(I,J)=Z(I,K)
0144                    QH(13,J)=Z(26,K)
0145                 23 CONTINUE
0146                 22 CONTINUE
0147                    DO  24  J=1,6
0148                    DO  45  I=1,13
0149                    THE(I,J)=QH(I,J)-ALP(I,J)*DSHAT(J)
```

```
0150              45  CONTINUE
0151              24  CONTINUE
0152                  DO  49  J=1,6
0153                  WRITE(6,602)J
0154                  WRITE(6,603) ( ALP(I,J),I=1,13)
0155                  WRITE(6,603) ( THE(I,J),I=1,13)
0156                  WRITE(6,603) (QH(I,J),I=1,13)
0157              49  CONTINUE
0158             602  FORMAT(///,10X,'CLASS',I5)
0159             603  FORMAT(/,5X,13(F8.4,1X))
0160             303  FORMAT(2X,13F6.4)
0161             504  FORMAT(///,4(5X,10(F11.5,1X),/))
0162             503  FORMAT(20X,'MATRIX A(40,40)',/)
0163             520  FORMAT(///,20X,'SOCIAL ACCOUNTING MATREX',//)
0164             555  FORMAT(7F11.5)
0165             509  FORMAT(7F11.5)
0166               4  FORMAT(13A2)
0167             101  FORMAT(/,5X,13(F8.3,1X))
0168             102  FORMAT(//,10X,6(E12.5,4X))
0169             103  FORMAT(13F6.3)
0170             104  FORMAT(12F6.1)
0171             105  FORMAT(/,2X,14(F8.3,1X))
0172             106  FORMAT(//,2X,13(F8.3,1X))
0173             521  FORMAT(///,20X,'TOTAL  GROSS PRODUCTION',//)
0174                  RETURN
0175                  END
```

```
                C       MATRIX INVERSE ROUTINE
0001                    SUBROUTINE MATINV(A,N)
0002                    DIMENSION A(N,N)
0003                    DO 1 I=1,N
0004                    X=A(I,I)
0005                    A(I,I)=1.0
0006                    DO 2 J=1,N
0007                  2 A(I,J)=A(I,J)/X
0008                    DO 1  K=1,N
0009                    IF(K-I)3,1,3
0010                  3 X=A(K,I)
0011                    A(K,I)=0.0
0012                    DO 4 J=1,N
0013                  4 A(K,J)=A(K,J)-X*A(I,J)
0014                  1 CONTINUE
0015                    RETURN
0016                    END
```

```
0001                  SUBROUTINE AMULB(A,B,C,I,J,K)
0002                  DIMENSION A(I,J),B(J,K),C(I,K)
0003                  DO 3 L=1,I
0004                  DO 3 M=1,K
0005                  C(L,M)=0.0
0006                  DO 3 N=1,J
0007                3 C(L,M)=C(L,M)+A(L,N)*B(N,M)
0008                  RETURN
0009                  END
```

11. Sample Output from a GEM-2 Solution

POLICY 1

TEST OF CONSISTENCY OF DATA INPUTS.

THE NEW PRICES ARE

0.999997	0.999997	1.000000	1.000001	0.999992	0.999998	0.999997
0.999998	0.999997	1.000004	0.999999	0.999999		

GROSS OUTPUT

	FINAL	INITIAL	CHANGE
STAPLE FOOD	454.599	455.000	-0.088
NON-STAPLE FOOD	1266.462	1268.000	-0.121
COTTON	234.986	235.000	-0.006
OTHER AGRICULTURE	463.359	464.000	-0.138
FOOD PROCESSING IND	1520.612	1522.000	-0.091
TEXTILE INDUSTRY	884.197	885.000	-0.091
OTHER INDUSTRIES	1391.496	1392.000	-0.036
CONSTRUCTION	635.981	636.000	-0.003
CRUDE OIL AND PRODUCTS	608.833	609.000	-0.027
TRANSPORT AND COMM	576.616	577.000	-0.066
HOUSING	141.743	142.000	-0.181
OTHER SERVICES	3116.843	3118.000	-0.037
TOTAL	11295.715	11303.000	-0.064

	YH	YD	YET	YE
1	1041.87769	1020.80029	1117.49512	1008.81201
2	1125.78345	1046.19873	1144.37939	1044.79834
3	1304.73682	1134.67114	931.91211	861.32617
4	720.32959	729.52026	659.68530	576.46265
5	533.98315	528.69312	385.46582	329.77173
6	502.88379	486.78735	314.02710	287.13330

SHAT EQUALS

507.42090 522.54858 430.74878 288.46973 165.18262 143.58504

HOUSEHOLD CONSUPTION BY CLASSES

1	21.97899	13.49968	5.29978	22.59233	7.09567	4.49961
2	179.00514	186.56789	110.68147	113.90292	65.68559	53.29036
3	1.61423	0.29985	0.39990	1.60238	0.59505	0.49981
4	14.24590	16.39618	11.79781	7.19513	4.27220	1.99946
5	323.76538	275.06860	140.38135	234.43149	100.49600	70.79108
6	79.38264	97.18326	55.09056	38.12221	30.83092	25.69453
7	95.27412	99.08127	60.28966	45.06862	23.22050	19.59526
8	0.0	0.0	0.0	0.0	0.0	0.0
9	21.84271	18.39790	9.39877	11.79312	4.69536	2.79964
10	29.77390	45.34021	170.75098	7.78436	6.27585	4.69889
11	16.52670	39.37767	55.28635	4.38647	3.37691	8.29776
12	207.49898	223.14717	152.67067	78.03108	63.28119	76.28578
13	15.45089	30.39040	89.28049	11.58398	19.46414	18.69635

OTHER IMPORTANT VARIABLES

	FINAL	INITIAL	CHANGE
EXPORTS	1286.008	1286.000	0.001
IMPORTS	1939.026	1940.000	-0.050
IMPORTS-EXPORTS	653.018	654.000	-0.150
INVESTMENT	1566.983	1567.000	-0.001
STOCKS	113.000	113.000	-0.000
TOTAL INVESTMENT	1679.982	1680.000	-0.001
PRIVATE SAVINGS	393.704	394.000	-0.075
PRICE DIFFERENCE	176.009	176.000	0.005
GOVT. SAVINGS	551.842	632.000	-12.683
DOMESTIC SAVINGS	945.546	1026.000	-7.842

GOVT. SECTOR

	EXPENDITURE	REVENUE	NET
PUBLIC UNDERTAKINGS	0.0	1413.335	1413.335
CONVENTIONAL	1716.855	1323.058	-393.798
TRADE	1479.030	1011.334	-467.696
TOTAL	3195.885	3747.727	551.842

LA,OR	CAPITAL AND LAND DEMAND									
127.9207	271.9260	92.1066	197.2650	39.9193	50.4049	41.9227	37.5242	4.0571	10.9442	49.4655	437.0200
88.3605	293.8555	63.0203	79.6058	93.5900	110.1203	67.5361	38.1295	53.9014	17.2624	74.1982	655.5303
72.4787	165.2024	46.8613	160.5239	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12.9736	23.0998	0.0	0.0	16.3538	116.2235	164.4419	94.3410	17.0210	164.6654	1.1103	868.7209
14.9868	50.9381	0.0	0.0	13.9872	52.9519	294.8928	83.9974	248.9317	260.8264	8.9837	86.9677